Research Synopsis

An Analysis of Effects of Trade Barriers on India's Exports

Submitted by

Vivek Tiwari

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Thesis Advisory Committee

Dr. Chandrima Sikdar, Chairperson

Dr. Subhadip Mukherjee

Dr. Chandan Dasgupta

Submitted to:

Chairperson, Research and Publications
SVKM's NMIMS University

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1. Introduction

International trade has played a pivotal role in the economic growth and development of countries across the world. After the Second World War, one of the efficacious remedies to lift economies out of the rut caused by wartime destruction and havoc was cross-border trade. Since then, trade has evolved as the backbone of the modern commercial arena. It has allowed nations to access valuable resources located in other countries and to use them to augment their domestic product range and capacities. On the other hand, trade has facilitated access of countries to new markets enabling them to showcase their comparative advantage on a global stage. At the same time, international trade has also played a major role in attracting foreign capital investment in countries helping them to modernize the production process and enhance the competitiveness of their domestic industries in the global marketplace.

While the volume of international trade and its importance to nations' growth and development have increased significantly over the years, the benefits of this growth have not been uniformly distributed among participating countries. One contributing factor is the presence of trade policy measures that countries must comply with as part of contemporary economic integration strategies. Commonly referred to as tariff and Non-Tariff Measures (NTMs) (Cadot et al., 2012), these policies are collectively categorized as trade barriers and have a profound impact on the structure of global trade and the participation of countries (de Melo and Nicita, 2019). In addition to tariff and non-tariff barriers, an emerging component of trade barriers in recent times involves trade costs at the importing country's border. These costs are primarily associated with lengthy administrative procedures, procedural delays, opportunity costs, inventory holding, and hidden expenses due to bribery and corruption.

In the era of Global Value Chains (GVCs), trade policy actions by one country are likely to have wide-ranging indirect effects on other nations within the same value chain. Measures such as tariffs, NTMs, and changes in border administrative procedures disrupt not only bilateral trade but also the broader network of countries participating in shared supply chains. In this context, this study attempts to identify and quantify trade restrictions and assess their broader economic and welfare implications. By examining India—an emerging economy with an increasing global presence—the research aims to provide insights into how trade barriers directly impact exporting nations and indirectly affect their trading partners along the value chain.

The rationale for choosing India is that its share in world exports is a meagre 1.8 per cent of total global exports (WTO, 2022) and this share grew at the rate of only 0.9 per cent during the last decade. This is, however, against the fact that the country is the second largest economy of the Asia-Pacific region with a Gross Domestic Product (GDP) of USD 3.54 trillion in 2023 (WTO). Despite its trade agreements with multiple countries and trading blocs and commitments under WTO, India is still subject to significant tariff, non-tariff and trading across border barriers from its trading partners. This possibly could be one of the reasons for the country's unimpressive export performance (Tiwari and Sikdar, 2024). The existence of high trade restrictions imposed by importers and lacklustre export performance against the super impressive growth performance makes India a perfect case for the present study.

2. Trade Barriers

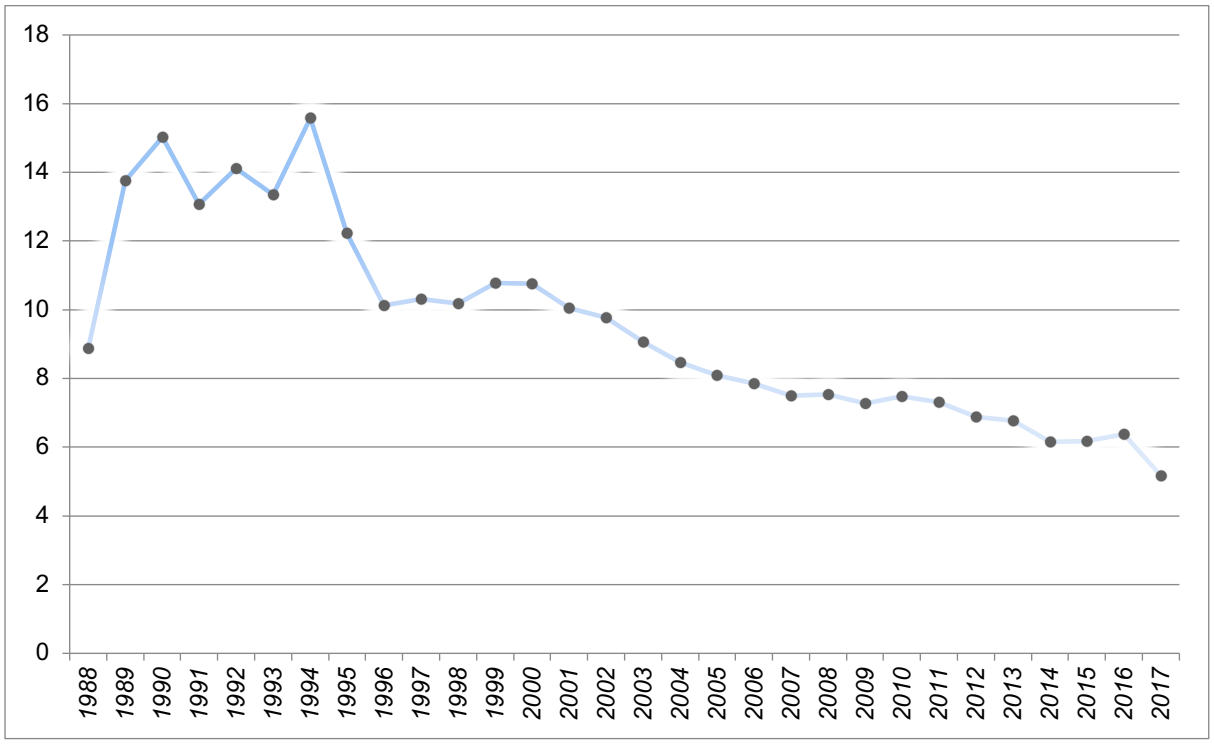
Trade barriers emerged as a dominant policy tool for policymakers worldwide to influence and control international trade transaction costs, and consequently, the volume of trade between countries. Traditionally, trade barriers in the form of tariffs have played a pivotal role in determining the quantum of trade flows between nations.

During the latter half of the 20th century, the liberalisation of trade regimes took place globally at different levels, namely, bilateral, regional and multilateral. The main effect of these collaborations was the effective reduction in the tariffs implemented by partner countries in cross-border trade. A major role in this transition was played by the various rounds of multilateral trade negotiations that took place under the General Agreement on Tariffs and Trade (GATT) from 1948 to 1994. It provided a framework to negotiate a reduction in tariffs among the member economies. The eventual need for a formal international organization with a broader mandate to govern the international trade arena led to the Uruguay Round of GATT (1987–1994), which culminated in the Marrakesh Agreement and laid the foundation for the establishment of the World Trade Organization (WTO). The WTO which came into being on January 1, 1995, incorporates the principles of the GATT and provides a more enduring institutional framework for implementing and extending such principles. The WTO operates a global system of trade rules, and acts as a forum for negotiating trade agreements; it settles trade disputes between its members and supports the needs of the developing countries (WTO, 2020). The primary purpose of WTO has been to open up trade for the benefit of all. As a

consequence global tariff liberalization continued largely unabated through the twenty-first century. Most of the tariff liberalization took place in the pre-crisis period (2002-2007) and slowed down post-2008.

Figure 1 indicates the trend of tariff rates across the globe since 1988. The graph indicates the phenomenal jump in the tariff rates in the late 1980s reaching its peak in 1994 and thereafter showing signs of subsiding with the formation of WTO in 1995.

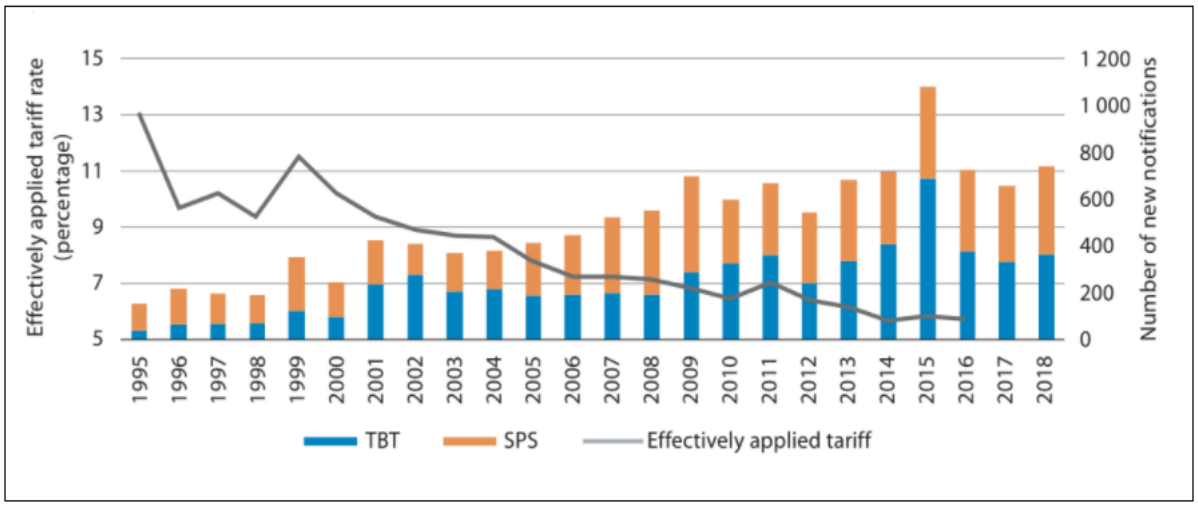
Figure 1 - Applied average world tariff rate between 1988 and 2018



Source – World Bank (https://data.worldbank.org/)

The gradual tapering of the tariff structure through various rounds of WTO on trade liberalization set the stage for the NTMs. With the waning significance of tariffs in the trade policies of countries, NTMs emerged as a trade policy tool to complement the existing tariff framework. Thus, NTMs are a fairly recent phenomenon which did not find any mention in the GATT regime. Soon these trade policy instruments began occupying the centre stage in playing a prominent role in the trade barrier structure erected by the trading countries against each other (*figure 2*). Thus, while import tariffs continue to exist as trade policy instruments, it is the non-tariff measures which have been exerting greater restrictions on trade flows across nations in recent times.

Figure 2: Average applied tariffs and annual new notification to WTO of SPS and TBT measures in the Asia-Pacific region.



Source - ESCAP, based on data from WTO and UNCTAD through WITS.

The following sub-section explains the type of import tariffs and non-tariffs and their use as trade policy instruments.

Import Tariffs - Types and use as trade policy tool

Import tariffs are taxes imposed by the government of a country on its imports. On a broader level, there are two ways in which tariffs are applied on imports: specific (non-ad valorem) tariffs and ad valorem tariffs. These tariffs are implemented as:

- Specific tariffs - the tariff value is a fixed financial value per unit of the imported item in the schedule (e.g. 10 dollars per kilogram);
- Compound tariffs - this is a combination of ad valorem and specific tariffs (such as 5 per cent along with 5 dollars per kilogram);
- Mixed tariffs - a combination of ad valorem and/or specific tariffs depending on the condition attached (e.g. 50 per cent / 5 dollars per kilogram, whichever is lesser)
- Technical tariffs - the tariff value dependent on the specifications of the ingredients in the imported item, e.g. calorific content in coal.

Non-tariff Measures - Types and use as a trade policy tool

Non-tariff measures (NTMs) include import and export quotas, export subsidies, voluntary export restraints and actions related to anti-dumping etc. These measures still do not have a

definite realm of application and new measures are being witnessed at a regular pace according to the sprouting trade practices by countries across the globe. Nonetheless, the broad definition of Non-Tariff Measures accepted worldwide has been as a trade policy measure that is used to distort trade (Linkins, (2002), Moore and Zanardi, (2011) & Ghodsi (2015)). The NTMs considered by the study are as per the data published by UNCTAD[1] which include import subsidies, quantitative restrictions, import licensing, customs barriers, quotas, anti-dumping measures, countervailing measures, Sanitary And Phytosanitary (SPS) measures and Technical Barriers To Trade (TBTs).

As far as the definition of the NTMs goes, a distinction with the concept of Non-Tariff Barriers (NTBs) is necessary. Whereas NTMs are loosely defined as non-discriminatory measures aimed at preserving legitimate interests such as environmental preservation, consumer health or security, NTBs are classified as a subset of the NTMs which are intended to be discriminatory and protectionist. However, the distinction between the two is an arduous task given the legal and economic complexities involved in their definition. Hence, this study uses the term Non-Tariff Measure (NTM) throughout its scope to denote the above two terms. Further, given the scope of the study, the discussion related to non-tariff barriers will stay focussed on non-tariff barriers applied to imports.

Trading Across Borders and its components

In international trade transactions, particularly those related to the exchange of merchandise, it is a common phenomenon to encounter certain delays at border points, primarily due to the necessity to adhere to the regulatory compliance standards set forth by the importing or the exporting nation. Such regulatory compliances result in trade costs at the borders that exist at various stages of goods delivery from the producer to the buyer across borders. These trade costs include the logistical expenses borne by exporters to transport their goods to their respective borders, costs associated with the exporting border, and expenses that emerge from regulatory frameworks and local impediments to conducting business at the importers' border. In this process, the costs at both exporter's and importer's borders are composed of direct, indirect costs and hidden costs. The direct costs are the result of trade restrictions, trade tariffs,

[1] The list is published by United Nations Conference on Trade and Development (UNCTAD) - https://unctad.org/topic/trade-analysis/non-tariff-measures/NTMs-classification

and lengthy administrative procedures. The indirect costs are the result of procedural delays, opportunity costs, and, finally, the hidden costs are the costs associated with bribery and corruption. (OECD, 2018).

In this context, the operational procedures concerning customs clearance, port documentation, and the involvement of intermediaries throughout the various phases of a trade transaction across borders predominantly hinge on intangible factors. These factors include the customary practices observed by the officials working for customs and port authorities. Given the involvement of entities such as shipping brokers, insurance providers, and freight forwarders in these transactions, the disparity in levels of knowledge among these stakeholders regarding the operational prerequisites, standards, and practices assumes a pivotal role in shaping the efficiency of cross-border trade activities (Persson, 2013).

One such category of trade barrier, in particular import barriers, is those imposed by the trading across border requirements that exporters have to face and comply with at the border of their respective import partners (Arvis et al., 2012). According to the World Trade Organization (2018), ineffective border compliance procedures can cause delays or bottlenecks at borders, which can raise costs, disrupt supply chains, and make businesses less competitive.

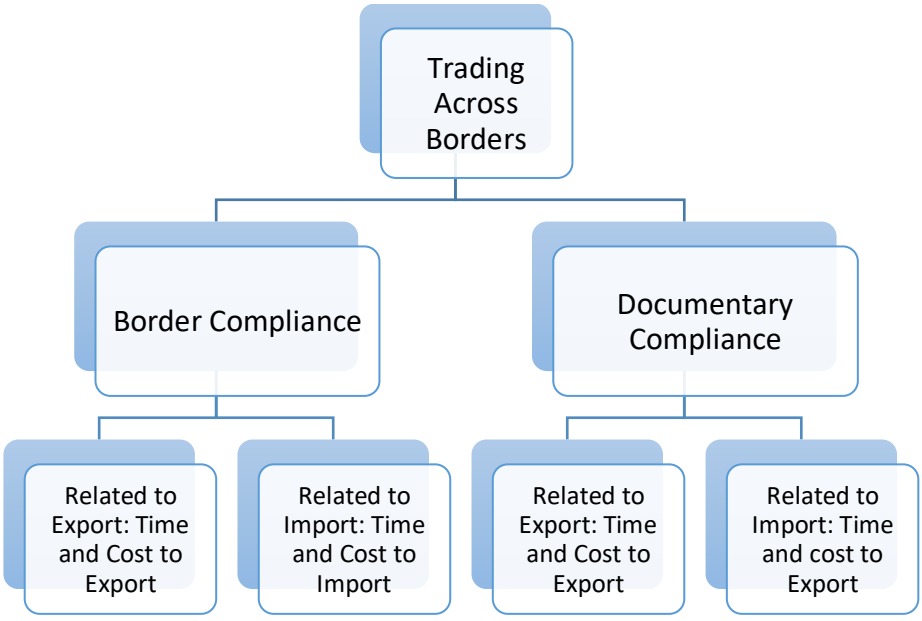
The procedure related to the submission and processing of documents required to facilitate cross-border trade transactions is referred to as documentary requirements, which generally includes origin certificates, import/export permits, and other trade-related paperwork. According to the International Chamber of Commerce (2019), extensive documentation procedures can impede trade flows and increase transaction costs, even while compliance with documentary requirements is crucial for guaranteeing the legality and authenticity of traded commodities.

The annual publication of the Ease of Doing Business Report[2] by the World Bank provides a comprehensive resource that offers valuable insights and data on the intricate process of "Trading across Borders". This particular metric entails a meticulous evaluation of a myriad of parameters aimed at gauging the various trade costs that are linked to the import and export

[2] As on date, the World Bank does not publish this report but the data was published on the World Bank website https://databank.worldbank.org/databases/business-regulations-and-enforcement. The report is till 2019 and covers the period of study of this study.

transactions that traverse the borders of different nations around the globe. Within the framework of this measurement, there exist two distinct components that are intricately interwoven - border compliance and documentary compliance. These components play a fundamental role in shaping and defining the overall efficiency and effectiveness of cross-border trade activities.

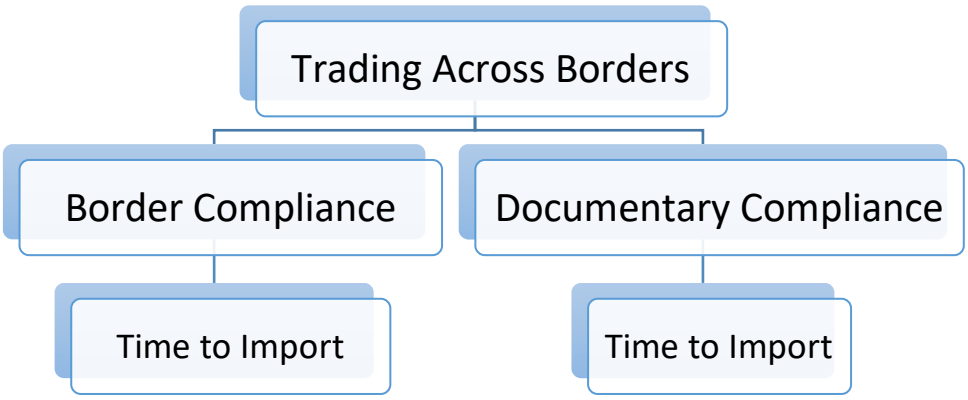
Figure 3: Components of Trading Across Borders as per World Bank's Ease of Doing Business Report


Trading Across Borders
Border Compliance
Documentary Compliance
Related to Export: Time and Cost to Export
Related to Import: Time and Cost to Import
Related to Export: Time and Cost to Export
Related to Import: Time and cost to Export

Source: Based on Doing Business Report 2019, World Bank

As per the above figure, the border compliance component covers time spent and cost incurred to complete procedures other than those related to documentation such as inspection of goods, clearance provided by customs authorities etc. The component of documentary compliance captures the time and cost associated with compliance with the documentary requirements of all government agencies of the origin economy, the destination economy and any transit economies. For each of these components, the World Bank report captures the time and cost for an export transaction and an import transaction separately (*Figure 3*). The scores reported corresponding to each of these components are compiled for individual countries through a questionnaire sent to port authorities, brokers, freight forwarders and traders in each country. The present study focuses on the part of each of these components which pertain to import and the time taken to import (*Figure 4*).

Figure 4: - Components of Trading across Borders considered in the study



Source: Doing Business Report 2019, World Bank

Thus, the trade barriers referred to in this study involve three barriers due to:

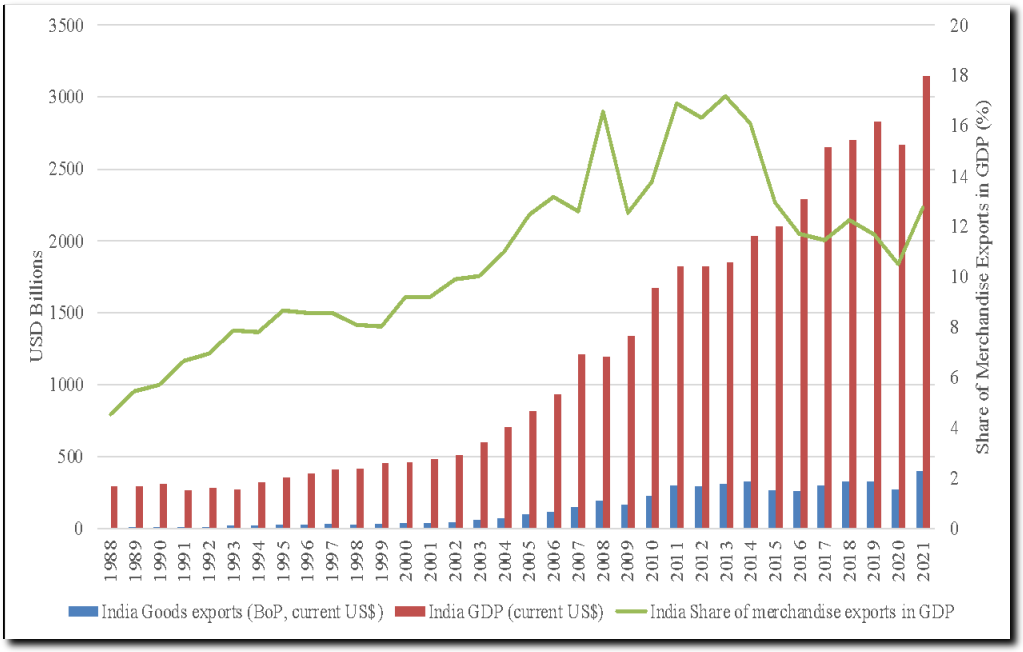
- Tariff barriers
- Non-tariff barriers
- Trading across border barriers

3. India's Exports to the world and trade barriers faced

Figure 5 shows India's merchandise exports and GDP in current US dollars (USD) from 1988 to 2021, along with the share of merchandise exports in GDP. Over this period, India's goods exports grew significantly from approximately USD 13.51 billion in 1988 to USD 402.42 billion in 2021. Simultaneously, India's GDP also increased from around USD 296.59 billion in 1988 to USD 3.15 trillion in 2021. The share of merchandise exports in GDP followed an upward trajectory, starting at 4.56 per cent in 1988 and peaking at 17.19 per cent in 2014, before settling at 12.77 per cent in 2021(WITS[3]). Some notable periods of growth include the early 2000s and the mid-2010s, highlighting India's increasing integration into the global trade system.

[3] https://wits.worldbank.org/countryprofile/en/country/IND/startyear/2017/endyear/2021/indicator/NE-TRD-GNFS-ZS

Figure 5 - Merchandise Exports growth vs. GDP growth of India during 1988 - 2021

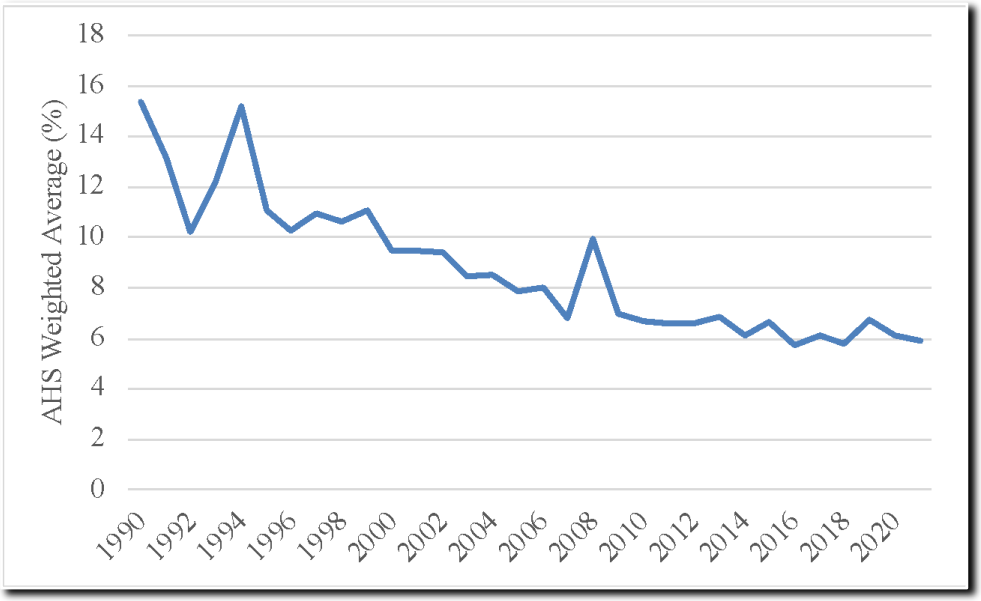

USD Billions
Share of Merchandise Exports in GDP (%)
India Goods exports (BoP, current US$)
India GDP (current US$)
India Share of merchandise exports in GDP

Source: Author's calculation based on WITS data

The graph showcased in Figure 6 provides a visual representation of the Applied Harmonized System (AHS) weighted average associated with India's export activities during the period 1990 to 2021. An examination of the trend showcases a series of fluctuations in the average import tariff, which stood at a notable 15.39 per cent in the year 1990, gradually tapering down to a mere 5.8 per cent come the year 2021 (WITS).

Throughout this period, India's export landscape has experienced dynamic phases with both increases and decreases in import tariffs by its trading partners. The early 1990s saw a substantial downturn, followed by a modest upturn in the mid-1990s. From the late 1990s to the early 2000s, there was relative stability before a significant decline around 2009, likely due to the global financial crisis. Additionally, non-tariff barriers, including technical standards, sanitary regulations, and regulatory requirements presented difficulties for Indian exporters, particularly SMEs. Owing to their inherent nature, these obstacles increase trade expenses, breed uncertainty, and restrict entry to international markets. Table 3 lays out the indicative details of the share of the top 25 trading partners and the nature of trade barriers faced by India with them in 2018.

Figure 6 - All Products AHS Weighted Average tariff (%) imposed by trading partners on India's exports during 1991-2021



Source: Author's calculation based on WITS database

A detailed examination of sector-wise NTMs imposed on Indian exports, based on the latest available data (WITS, 2018), reveals a clear picture. As shown in Table 1, the NTM-affected trade volume represents the total export volume impacted by NTMs imposed by partner countries on an aggregate level.

Table 1 - NTMs imposed on Indian exports in 2018

Sector	NTM Coverage ratio	NTM Frequency ratio	NTM impacted goods - count	NTM impacted trade (mn USD)
Textiles and Clothing	100.0	100.0	792	6.0
Vegetable	99.9	96.9	247	18.8
Food Products	99.8	99.5	184	2.3
Animal	86.0	87.2	95	0.2
Fuels	75.4	13.2	5	95.1
Hides and Skins	48.8	31.3	21	0.5
Transportation	40.6	62.4	78	6.3

Sector	NTM Coverage ratio	NTM Frequency ratio	NTM impacted goods - count	NTM impacted trade (mn USD)
Wood	34.8	9.5	22	2.6
Stone and Glass	33.0	21.1	40	19.5
Metals	29.2	18.3	102	7.6
Chemicals	28.5	37.6	284	10.8
Minerals	16.5	28.1	27	1.5
Mach and Elec	14.4	14.9	114	9.7
Plastic or Rubber	10.8	16.6	35	1.6
Miscellaneous	5.8	8.3	29	0.6
Footwear	3.9	25.5	12	0.0
All Products	**45.5**	**43.7**	**2,087**	**182.9**

Source: WITS

In 2018, Indian exports faced diverse Non-Tariff Measures (NTMs) across sectors, with a 45.5 per cent overall coverage ratio impacting 2,087 products and trade worth USD 182.9 million. The Textiles and Clothing sector experienced complete regulation (100 per cent coverage and frequency ratios) affecting 792 goods, followed closely by the Vegetable sector (99.9 per cent coverage) and Food Products (99.8 per cent coverage). Notably, while the Fuels sector had a relatively lower frequency ratio of 13.2 per cent, it represented the highest trade value impact at USD 95.1 million, followed by Stone and Glass (USD 19.5 million) and Vegetables (USD 18.8 million). Contrasting this, sectors like Miscellaneous and Footwear faced minimal NTM coverage (below 6 per cent), and sectors such as Footwear and Animal products showed negligible trade value impact (≤ USD 0.2 million).

Table 2 - Share (per cent) of NTM applied by trading partners on India's exports - 2018

Commodity	No NTMs	1 type	2 types	3+ types
Animal	58.33	22.81	16.67	2.19
Chemicals	64.01	25.6	10.01	0.38
Food Products	4.66	47.15	45.6	2.59
Footwear	75.51	24.49		
Fuels	88.1	11.9		
Hides and Skins	69.57	30.43		
Mach and Elec	85.18	13.39	1.3	0.13
Metals	82.04	15.49	2.46	
Minerals	72.64	24.53	2.83	
Miscellaneous	91.99	8.01		
Plastic or Rubber	83.41	16.59		
Stone and Glass	79.59	20.41		
Textiles and Clothing	0.75	1.25	85.89	12.11
Transportation	40.46	4.58	52.67	2.29
Vegetable	17.94	13.29	60.47	8.31
Wood	90.72	8.86	0.42	
All Products	**58.59**	**15.46**	**23.2**	**2.75**

Source: WITS

Table 2 illustrates the extent of Non-Tariff Measures (NTMs) in imports for different product categories by the trading partners of India. About 58.6 per cent of all import items are not subject to NTMs, compared to 15.4 per cent which face one or the other kind of NTM, 23.2 per cent, which face two types, and 2.7 per cent which face three or more types. In terms of Trading across borders costs also, India has faced substantial restrictions from its import partners as is presented in Table 3 (refer to the last four columns).

Thus, India, which is subject to these trade barriers, might have been impacted considerably in terms of the volume of its exports reaching these countries and hence these policy barriers could be the reason for India's rather unimpressive export performance against the backdrop of its remarkable growth performance. Thus, the impact of these trade barriers on India's exports calls for in-depth scrutiny and analysis. The following section attempts a discussion on the same.

Table 3: India's exports in 2018 to its top twenty-five export markets and the import barriers imposed by them

	Partner Name (Top 25 in 2018)	Export (US$ Million)	No. of exported HS6 digit Products	Tariff		NTM	Time to import		Cost to import	
				Effectively Applied tariff weighted average (customs duty)	MFN weighted average tariff	NTM affected product count	Border Compliance (in hrs)	Documentary Compliance (in hrs)	Border Compliance (USD)	Documentary Compliance (USD)
1	United States	51,629	3,705	1.67	3.19	3174	2	8	175	100
2	United Arab Emirates	28,523	3,633	4.75	4.71	3096	54	12	553	283
3	China	16,366	2,740	3.83	4.27	NA	37	11	230	75
4	Hong Kong, China	13,132	2,128	0	0	NA	19	1	226	57
5	Singapore	10,444	2,808	0.07	0.68	1343	33	3	220	40
6	United Kingdom	9,741	3,212	1.79	2.99	NA	3	2	0	0
7	Germany	8,948	3,280	1.79	2.99	NA	0	1	0	0
8	Bangladesh	8,739	3,332	11.82	12.32	NA	216	144	900	370
9	Netherlands	8,654	2,376	1.79	2.99	NA	0	1	0	0
10	Nepal	7,297	3,878	12.3	13.07	1005	11	48	190	80
11	Belgium	6,806	2,163	1.79	2.99	NA	0	1	0	0
12	Vietnam	6,697	2,363	2.69	5.88	2340	56	76	373	183
13	Malaysia	6,550	2,918	4.02	4.02	1862	36	7	213	60
14	Italy	5,518	2,664	1.79	2.99	NA	0	1	0	0
15	Saudi Arabia	5,487	2,928	4.85	5.02	3349	72	32	464	267
16	France	5,275	2,614	1.79	2.99	NA	0	1	0	0
17	Turkey	5,189	2,354	3.45	4.56	3310	7	2	46	55
18	Korea, Rep.	4,804	2,319	5.04	9.07	NA	6	1	315	27
19	Indonesia	4,790	2,476	2.06	5.89	2797	80	106	384	160
20	Japan	4,738	2,569	2.5	3.03	3066	48	3	275	107
21	Sri Lanka	4,665	3,402	8.72	9.16	2254	72	48	300	283
22	Thailand	4,383	2,758	3.52	6.86	1508	50	4	233	43

23	Spain	4,099	2,343	1.79	2.99	NA	0	1	0	0
24	South Africa	4,017	2,789	4.61	6.29	NA	87	36	676	73
25	Mexico	3,830	1,987	1.21	3.93	2472	44	18	450	100
Total		2,40,323	69,739							
Share (%) in India's export		**75**								

Source: Author's calculations based on data from the WITS database

4. Literature Review

Introduction

In the early post-World War II period, the formation of the General Agreement on Tariffs and Trade (GATT) in 1947 set a critical turning point in the study of trade barriers. The primary focus of academic work during this time was on understanding the role of tariffs and the economic impacts of tariff reductions agreed upon in successive GATT rounds. Irwin (1994) provides a historical perspective on GATT, highlighting its significance in shaping post-war trade policy and reducing tariffs globally. Additionally, traditional trade theory, grounded in the Heckscher-Ohlin model, emphasizes tariffs' roles in resource allocation and income distribution. Samuelson (1948) contributes to this theoretical foundation by exploring the relationship between tariffs, trade, and factor price equalization.

In a parallel strand, academic literature on trade barriers focussed on quantifying their impact on trade volume. Leamer (1974) is one the earliest seminal work in this domain, which culminates in Leamer (1990). These series of studies provide reviews of trade barriers followed by empirical estimation of their effects on international trade. Starting with the general factor proportion model of trade as the underlying theoretical framework, Leamer (1990) subsequently conducts an econometric analysis to explain the effect of trade barriers on import flows. It concludes that while the effect of tariffs on a country's imports is substantial, the influence of NTMs on trade cannot be easily detected.

The divergent perspectives on the role of trade in economic growth are widely recognized, with some scholars positioning trade as the primary 'engine' of growth, as articulated by Lewis (1980), while others view it as a supportive 'handmaiden' of growth, a stance Kravis (1970) and Riedel (1984) advocates. This debate evolves into a discussion on the role of the policies affecting the trade flow across national boundaries.

Studies on Tariffs and their impact on global trade

Historically, import tariffs have been imposed by the government of a country on imported goods from other countries to protect their domestic industries. The Stolper-Samuelson theorem, originally proposed by Stolper and Samuelson (1941), gains prominence in

explaining how tariffs affect income distribution within countries. It highlights that protectionist tariffs could benefit the abundant factor in a country while harming the scarce factor.

With the advent of the WTO, one of its primary objectives was to continue the reduction of tariffs, a process initiated under the GATT. The WTO's tariff reduction commitments were more binding and covered a broader range of goods and services. Bhagwati (1998) provides a comprehensive analysis of the WTO's role in reducing tariffs and promoting trade liberalization, particularly for developing countries. The study discusses the benefits of lower tariffs in terms of increased market access and economic growth. While the overall trend was toward lower tariffs, certain sectors, notably agriculture, faced slower progress. Anderson and Martin (2005) specifically addresses the challenges of agricultural trade reform under the Doha Development Agenda. Their work highlights the persistence of high tariffs on agricultural products and the complexities involved in achieving meaningful reforms, given the sector's political sensitivity.

Kee et al. (2004) uses the GDP function approach to estimate demand elasticities for 4,625 imported commodities in 117 countries. The study then uses these estimates to develop theoretically sound trade restrictiveness indices and GDP losses associated with existing tariff regimes. Goerzen et al. (2016) study the impact of various import tariffs on trade as a proportion of GDP and discover a negative relationship between a country's import tariff and total trade as a percentage of GDP. Alternatively, a reduction of tariffs can result in a rise in trade, as seen in the case of China after its entrance into the WTO. Import tariffs and export taxes on minerals and metals have significantly impacted global supply chains, leading to increased trade costs and trade barriers (Korinek, 2019). Datta (2021) highlights that tariff wars are a result of the disparity between the trade motives between developed and developing countries by studying the effect of tariff wars as a GDP percentage and its effect on per capita GDP. This study demonstrates that when world tariffs are measured using a simple mean of all products, both the effect on trade and per capita income is positive and significant. However, when measured using a weighted mean of all products, tariffs demonstrate a negative and statistically significant impact on both trade and per capita income, with a particularly notable decline in world per capita income in the short run.

Studies on the effect of non-tariff measures on global trade

In the post-World War II period, the influence of the NTMs was noted but not extensively analysed in the studies related to trade barriers. Early mentions included descriptive accounts of quotas and licensing systems, as seen in Salvatore (1998), which recognizes their existence but does not elaborate on their economic impact.

During the 1960s and 1970s, NTMs, like SPS and TBT interventions, began to attract increased focus. Baldwin (1971) examine various NTM types and their effects on trade, systematically categorizing them and analysing their trade-distorting effects. Subsequently, Deardorff and Stern (1985) develope methods to measure NTMs, thereby facilitating empirical assessments of their economic impact. In a similar vein, Grossman and Helpman (1994) examine why countries adopt protectionist trade policies, study their implications, and demonstrate how political forces and lobbying could lead to the implementation of trade barriers.

Maskus (2000) studies how strict Intellectual Property Rights (IPR) restrictions can act as NTMs and impact international trade and provides a thorough examination of the trade-off between protecting intellectual property and enabling market access for foreign enterprises. In related work, Maskus, Wilson, and Otsuki (2000) create a novel approach for evaluating the impact of TBTs by stressing their economic expenses, such as compliance costs and reduced trade flows and demonstrate how eliminating or reducing TBTs might improve trade efficiency and cut trade costs.

Estevadeordal and Suominen (2004) studies the components of NTMs and conducts a detailed examination of rules of origin (RoO) by mapping the various RoO applied in different regional trade agreements (RTAs) and analyses their economic impact on trade flows. It demonstrates how these measures can act as significant trade barriers due to the complexities and compliance costs associated with RoO. In a similar domain, an earlier work by Gawande and Krishna (2003) provides a comprehensive empirical analysis of how political forces shape trade policy by examining the motivations behind the adoption and persistence of NTMs and emphasizing the role of interest groups and lobbying. They demonstrate that NTMs are often the result of political bargaining and pressure from domestic industries seeking protection.

Other subject-specific studies have examined the effect of NTMs on the comparative advantage and trade patterns among the partner countries and highlight the distributional effects of NTMs

over sectors and regions (Anderson & Neary, 2003, 2005). In a significant contribution towards this strand of literature, Sala (2007) studies the proliferation of preferential trade agreements in the face of evolving trade protection and concludes that such trade agreements, along with quota-restricted trade, result in welfare gain for the member economies.

Fugazza and Maur (2008) also study the prevalence and economic impact of NTMs in a post-tariff world by using extensive data analysis using CGE modelling to demonstrate that NTMs, such as quotas, import licensing, and SPS measures, pose a significant challenge in their quantification. Hoekman and Nicita (2011) emphasize the role of trade facilitation measures in reducing trade costs and enhancing trade flows while studying the impact of trade policies and trade costs, particularly NTMs, on developing countries. They analyze a broad range of NTMs, including customs procedures and regulatory measures, and provide evidence of the disproportionate adverse effect of these measures on developing countries. Cadot, Malouche, and Sáez (2012) provide a practical and comprehensive toolkit for offering detailed guidelines and recommendations on how to identify, measure, and reduce the trade-restrictive effects of NTMs. Disdier, Fontagné, and Cadot (2015) studies the standards harmonization between developed (North) and developing (South) countries on international trade using a gravity model to analyze trade flows and observed that harmonizing standards between North and South significantly boosted trade by reducing the compliance costs and uncertainty faced by exporters from developing countries. One of the most significant contributions to the academic literature (Ghodsi, 2015; Ghodsi & Stehrer, 2016; Ghodsi et al., 2017) scrutinizes the regional dimensions of NTMs, particularly in developing regions and provides empirical evidence on the trade-enhancing effects of reducing NTMs within regional trade agreements. Amiti et al. (2019) analyzes the recent developments in NTMs amidst trade conflicts between the major trading economies and global supply chains and highlights the need for coordinated policy responses for the NTMs' role in trade wars and their economic costs.

Studies on Trade costs and their impact on global trade

The literature available on trade costs involving transportation and border costs is relatively recent. A large part of this literature provides evidence of the fact that trade costs are an important determinant of the volume of trade, and the impact is almost always negative. Anderson and Marcouiller (2002) cite hidden transaction costs as a major factor that hinders trade between low-income countries. These hidden costs comprise corrupt practices, lack of

trading infrastructure and legal framework to enforce contracts, etc. On a related subject, Anderson and van Wincoop (2003) observes that national borders reduce trade among industrialized countries by 20 to 50 per cent. In a cross-sectional gravity equation that includes both international and domestic sales, the study employs international border dummies to adjust for international trade costs relative to intra-national trade expenses. Yi (2010) assigns two distinct factors to the increase in trade costs. First, there is the border effect, when items manufactured in different stages of different nations cross national boundaries throughout manufacturing, resulting in numerous trade expenses. The second consequence is known as the vertical specialization effect, where import duties are applied to the customs value of gross exports as if imported items were made entirely in the exporting nation, even if they may contain values added earlier in the production process in other nations. It is evident that these two effects are not wholly distinct: intermediate products that traverse several boundaries experience vertical specialization.

De (2006) examines trade costs related to Northeast Asia and concludes that a 10 per cent saving in transaction costs increases imports by about 5 per cent to the region. Hummels and Schaur (2013) have quantified the effect of transit time taken by goods through ports of destination countries with a comparison of the choice of mode of transport between air and ocean cargo and estimate that for every single day taken in transit, an ad valorem equivalent tariff of 0.6 to 2.3 per cent is added to the cost.

Prabir De (2011) carries out an extensive econometric analysis of the relationship between trade costs, the transit of goods and the trade volume in the South Asian region. He concludes that along with reducing the trade barriers, the administrative trade facilitation measures also have a significant bearing in enhancing trade in the region. In an earlier related work, De and Ghosh (2008) suggests methodologies to quantify these border costs and provide a framework for policymakers to assess and prioritize trade facilitation measures aimed at reducing administrative burdens.

Shepherd (2022) highlights the role of the quality of infrastructure in reducing trade costs by emphasizing the need for investments in transport and logistics infrastructure to enhance border efficiency, especially in the context of global value chains.

Studies involving trade restrictiveness of trade policy tools and processes

A related branch of literature is devoted entirely to computing the trade restrictiveness implied by trade policy measures such as tariffs and NTMs and transaction and border costs. Anderson and Neary (1994, 1996) contribute extensively to providing measures of trade restrictiveness. Anderson and Neary (1994) present a trade restrictiveness index equal to the uniform tariff, which is the welfare equivalent of a specific arrangement of trade protectionism. This measure is solidly grounded in theory and covers tariffs and quantitative restrictions. Later, Anderson and Neary (1996, 2003) suggest an index that is a general equilibrium utilization of the distance function, referring to a standard set of trade restrictions that is welfare equivalent to the original protective structure, resulting in a novel approach to measuring trade restrictiveness. Anderson and Neary (2005) extend the standard theory of index numbers that apply to prices, output, or productivity by developing index numbers that apply directly to policy variables. Kee et al. (2009) provide a theoretically supported definition of trade restrictiveness for 78 countries comprising developing and developed economies. The study's findings imply that poor countries have trade policy restrictions in place and face higher trade barriers on their exports.

Beghin, Disdier, and Marette (2015) make significant strides in developing trade restrictiveness indices (TRIs) in the context of non-tariff measures (NTMs). Their work focuses on creating indices that account for the externalities often associated with NTMs, such as sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT). The study applies the developed indices to a variety of sectors and countries and demonstrates the varied effects of NTMs on trade flows.

In one of the most comprehensive studies, Ghodsi, Gruebler and Stehrer (2016) analyze the direct and indirect effects of trade policy measures on the global economy by measuring the bilateral ad-valorem equivalents (AVEs) of nine distinct categories of non-tariff measures (NTMs) and then computing the cumulative bilateral trade restrictiveness indices (BRIs) by summing the AVEs of NTMs and tariffs. Thereafter, these BRIs were used to assess the indirect impacts of trade policy actions on the global economy. Based on the premise of Ghodsi, Gruebler and Stehrer (2016), Sikdar (2018) analyzes the impact of trade barriers faced by the Indian food importers from China by calculating a bilateral trade restrictiveness index incorporating both tariff and non-tariff measures. In the next stage, the study calculates the indirect trade restrictiveness experienced by downstream importing countries. The important

contribution of this study is the augmented measure of NTMs, which includes standard NTMs along with the component of trade costs at borders. The results suggest that the actual impact of NTMs on trade may be significantly underestimated if only the number of NTMs and the corresponding AVEs are considered without considering the trading costs at the border.

Studies on Economic and Welfare Effect of Trade Barriers

The effects of the imposition of trade barriers can be categorized in different ways. Beghin (2006) highlights that the most important economic effect of the Non-Tariff Barriers prevalent in international trade is the protectionist effect. Modelling the protectionist effect of trade restrictions becomes crucial considering the price differential it causes between the market price and the domestic pricing in the exporting country and the market price and the domestic price in the importing country. (Fuguzza and Maur, 2008).

Baldwin and Evenett (2009) link trade barriers, especially the surge in protectionist measures during the financial crisis of 2008, to the exacerbating economic downturns globally. The research highlights the hindering effect of increased tariffs and NTMs on international trade flows, amplifying the negative impacts of financial crises on welfare and economic stability. In another seminal work, Kee et al. (2009) focus on quantifying the trade restrictiveness of NTMs and their implications for income inequality through their trade restrictiveness index. They demonstrate that NTMs raise trade costs and reduce market access, disproportionately impacting small and medium-sized enterprises (SMEs) and lower-income households within and across countries.

Using the GTAP model, Nag and Sikdar (2011) study the welfare implications of the India-ASEAN Free Trade Agreement by employing 'equivalent variation' (EV) to measure welfare changes in US dollar terms. The study noted that while larger ASEAN members are positioned to gain immediate welfare benefits through improved terms of trade, India's substantial gains are projected to materialize only upon full implementation of the agreement, primarily through resource reallocation and changes in allocative efficiency. However, India faces challenges in the form of negative 'terms of trade' effects due to its high import demand and ASEAN's pricing advantages. Subsequently, in another study, Sikdar and Nag (2020) analyze the growth in India’s manufacturing sector due to the India-ASEAN Free Trade Agreement using the CGE modelling framework of the GTAP database. They simulate the trade liberalisation scenario

due to the FTA and observe that the manufacturing sector benefits from the agreement for unskilled labour only.

The challenge of collecting of accurate trade data for welfare analysis is another significant strand in literature which has attracted the attention of various scholars. Gehlhar (1996) addresses the significance of accurate data in studying the welfare effects of trade policies by emphasizing how data quality impacts the robustness of trade policy analyses and underlines that inconsistent data can lead to erroneous conclusions about the effects of trade barriers. To address these discrepancies, he introduces various methodological approaches, such as using mirror statistics and cross-checking with other data sources. In a related strand, Eggar and Wolfmayr (2014) also emphasize the critical role of data accuracy in analyzing the welfare effects of trade barriers. Their research addresses common issues related to data quality, such as measurement errors, misreporting, and inconsistencies in trade data, which can significantly bias the results of welfare analyses. They highlight how inaccuracies in data can distort the estimation of trade elasticities and the subsequent welfare impacts of trade barriers, underlining the significance of comprehensive and harmonized international trade databases to enhance the reliability of empirical trade analyses and policy recommendations.

In a seminal contribution to the above field, Yotov et al. (2016) significantly advances the field of trade policy analysis through their work on structural gravity models. Their comprehensive guide provides a detailed methodological framework for estimating gravity models, which account for multilateral resistance terms and firm heterogeneity. This allows for a more accurate isolation of the effects of trade barriers on bilateral trade flows and economic welfare. Furthermore, they demonstrate how structural gravity models can be used to simulate the impact of various trade policy changes, including the imposition or elimination of tariffs and non-tariff measures (NTMs).

Studies exploring trade barriers experienced by Indian exporters

India's export sector has evolved significantly since independence, facing various trade barriers throughout its journey. In the early post-independence period, India adopted an inward-looking economic policy, which, combined with global protectionist measures, limited its export potential (Panagariya, 2004). The 1970s and 1980s saw Indian exports encountering numerous trade barriers in international markets. Bhagwati et al. (1975) documents the prevalence of

tariffs, quotas, and non-tariff barriers hindering Indian exports, particularly in developed economies.

The economic liberalization of 1991 marked a turning point. Ahluwalia (2002) notes that this period saw a shift towards export-oriented policies and a reduction in domestic barriers. In 1995, the establishment of the World Trade Organization (WTO) provided a new platform for addressing trade barriers. Mattoo and Subramanian (2003) highlight India's active participation in WTO negotiations. However, on a bilateral level, De and Ghosh (2008) argue that the impact of these negotiations on reducing barriers to Indian exports remained limited, particularly in sectors like agriculture and textiles. However, as Veeramani (2012) points out, despite these reforms, the composition of India's exports remained largely unchanged until the early 2000s, indicating persistent external barriers and domestic constraints.

As global tariff levels declined in the early 2000s, non-tariff barriers became increasingly prominent. Bown and Tovar (2011) document the rise of TBTs and SPS measures hurting Indian exports. Veeramani and Saini (2011) further analyze the effect of these non-tariff measures on India's agricultural exports, highlighting their trade-restrictive effects.

The global financial crisis of 2008 led to a surge in protectionist measures worldwide. Evenett (2009) reports an increase in anti-dumping investigations and countervailing duties against Indian products during this period. De and Iyengar (2014) examine the impact of these measures on India's exports, finding significant negative effects, particularly in manufacturing sectors. The study recommends the creation of economic corridors to leverage the integration of physical infrastructure and economic opportunities like trade and investment.

Recent years have seen India actively pursuing bilateral and regional trade agreements to overcome trade barriers. However, Kumar and Ahmed (2015) point out that these agreements have had limited success in boosting exports. Veeramani et al. (2018) provide a critical assessment of India's free trade agreements, suggesting that their impact on export growth has been modest due to various factors, including complex rules of origin and limited product coverage.

Separately, Chatterjee and Subramanian (2020) argue for a comprehensive strategy to address both domestic constraints and external barriers to boost India's exports. This view is echoed by Veeramani and Aerath (2020), who emphasize the importance of integrating into global value chains and addressing non-tariff barriers to enhance India's export performance.

The COVID-19 pandemic introduced new dynamics in global trade. De (2020) examines the pandemic's effect on India's trade and investment, highlighting the need for policy reforms to enhance export competitiveness in the post-pandemic world. Sen et al. (2024) analyze the pandemic's impact on Indian exports, noting disruptions in supply chains and new health-related trade restrictions.

5. Research Gap and Contribution to Literature

This thesis focuses on three primary objectives corresponding to the three stages of analysis:

1. To analyse the direct bilateral trade restrictions imposed on Indian exporters by its top 25 import partners with respect to its top 20 export products and develop an augmented measure of direct trade restrictiveness based on tariff, non-tariff, and administrative and procedural requirements related to cross-border trade.

2. To analyse the indirect bilateral trade restrictions on import partners due to trade restrictiveness imposed on Indian exporters by them and develop the Indirect Bilateral Trade Restrictiveness Index (IBRI) for each of the top 25 downstream partners of Indian exports in the global value chain.

3. To investigate the trade, macroeconomic and welfare impact of direct trade restrictiveness on India and indirect trade restrictiveness on its 25 partner economies.

This thesis contributes to three distinct strands of the literature. First, the study addresses a significant gap in the literature by comprehensively evaluating the combined impact of tariffs, non-tariff measures, and trading across border requirements on Indian exports.

Second, the thesis incorporates the often-overlooked aspect of documentary and border compliance requirements at importers' borders. Unlike previous research that has focused primarily on tariff and non-tariff measures, this study recognizes these border compliance requirements as potent trade barriers, providing a more comprehensive understanding of the challenges facing export transactions.

Third, the thesis takes the case study of India, detailing the trade barriers faced by Indian exporters and identifying the potential hindrances to exports from different industries in India to global markets.

The methodology employed in this thesis involves rigorous quantitative analysis to quantify the extent and nature of trade constraints faced by Indian exporters. It utilizes robust analytical methods and gravity modelling to calculate trade restrictiveness indices and evaluate the extent of overall trade barriers on Indian exports. Furthermore, the study employs general equilibrium modelling techniques to evaluate the broader economic implications of trade barriers on key variables, including sectoral output, employment, and welfare of the trading partners.

6. Research Objective

This study aims to examine trade restrictions imposed by trade policy tools and cross-border procedures and administrations of importing countries on their export partners, propose relevant augmented trade restrictiveness measures, and hence investigate the impact of such restrictions on the exporting country as well as its trade partners. For the empirical implementation, the study considers the case of Indian exports. Accordingly, the objective of this study is to address the following critical questions.

Objective 1: To analyze the direct bilateral trade restrictions imposed on Indian exporters by its import partners and develop an augmented measure of direct trade restrictiveness based on tariff, non-tariff, and administrative and procedural requirements related to cross-border trade.

- Sub-objective 1(a): What is the direct trade restrictiveness imposed on India's exports by its importers?
- Sub-objective 1(b): What is the share of each of tariff, non-tariff, and trading across border requirements in the overall trade restrictiveness?
- Sub-objective 1(c): Has the share of each of these components remained constant over the years?
- Sub-objective 1(d): Do the components' contribution to trade restrictiveness change with respect to destinations and composition of export baskets?

- Sub-objective 1(e): How important is trading across border requirements in terms of contributing to direct trade restrictiveness?

Objective 2: To analyze the indirect bilateral trade restrictions on import partners due to trade restrictiveness imposed on Indian exporters by the import partners.

- Sub-objective 2(a): Do the adverse impact of trade restrictions imposed on exporters by importing partners remain confined to the exporters, or do they have any indirect restriction implications for the importers themselves?

- Sub-objective 2(b): How large are the indirect restrictions as compared to the direct restriction on the exporter?

- Sub-objective 2(c): What is the share of each of tariff, non-tariff, and trading across border requirements to the total indirect trade restrictiveness?

- Sub-objective 2(d): Which variables decide the magnitude of this indirect trade restrictiveness?

Objective 3: To investigate the economy-wide impact of direct trade restrictiveness on the exporting country and indirect trade restrictiveness on the importing country.

- Sub-objective 3(a): What is the macroeconomic and sectoral impact of the trade barriers on the exporting economy?

- Sub-objective 3(b): What is the welfare impact of the trade barriers on the exporting economy?

- Sub-objective 3(c): What is the contribution of each of tariff, non-tariff and trading across border requirements to the welfare position of the exporter?

- Sub-objective 3(d): What is the trade impact on the importing economy due to the trade barriers effected by them on the exporting economy?

- Sub-objective 3(e): What is the welfare impact on the importing economy of the trade barriers imposed by them on the exporting economy?

- Sub-objective 3(f): What is the contribution of each of tariff, non-tariff and trading across border requirements to the welfare position of the importer?

The study analyses the above research questions and presents a comprehensive study of developing a measure of direct and indirect trade restrictiveness based on tariff, non-tariff, and trade costs imposed by importing countries and uses the restrictiveness measure to gauge the output, trade, welfare, and employment impact of the trade restrictions. Using data from India, the study develops a trade restrictiveness index based on the gravity model and input-output framework. It then applies these indexes within a Computable Generable Equilibrium (CGE) modelling framework to evaluate the output, trade, and welfare implications.

7. Methodology and Results

The study undertakes the analysis of India's top twenty export products at HS six-digit tariff classification and considers the exports of these commodities to its top twenty-five export partners.

As part of the methodology, the study is divided into the following sections

1. Analysis of trade barriers & calculation of total tariff equivalents due to the three trade barriers of tariff, non-tariff, and trading across borders as DBRI.
2. Calculation of indirect bilateral trade restrictions on import partners due to trade restrictiveness imposed on Indian exporters by the import partners, in the form of IBRI.
3. Assessing the macroeconomic, trade and welfare implications of barriers on India and other countries along the value chain.

7.1 Analysis of trade barriers & calculation of tariff equivalents

In terms of the methodology used for constructing the trade restrictiveness measure, the paper draws on the methodology of Ghodsi and Stehrer (2016) that applied to tariff and non-tariff restrictions and extends that of Sikdar (2018), which considered restrictions due to tariff, non-tariff and border trade cost. Accordingly, the trade restrictiveness measure or trade restrictiveness index, as it is henceforth referred to, is defined as the sum of restrictions originating from tariffs, NTM and TAB restrictions imposed by an importing country.

To calculate this, first, tariff equivalents or AVE for each of the NTMs and TABs are calculated, and then these tariff equivalents are added to the ad valorem tariffs. The resulting figure, following this addition, represents the total tariff equivalent imposed by an import partner (i) on the good (h) exported from a country (j). This is presented as follows:

$$Tariff\ Equivalent_{hij} = Tariff_{hij} + AVE\ of\ NTM_{hij} + AVE\ of\ TAB_{hij} \quad (1)$$

The calculation of tariff equivalents of the NTMs and the TABs involves the following four steps:

- First, import demand elasticities in each of the partner countries of the exporting country are obtained.
- Second, the effects of NTMs and TABs of each partner on their respective import quantities are estimated using a gravity model.
- These effects are then transformed into AVEs for each of the NTMs and TABs – for each country based on the import demand elasticities obtained at the first step.
- Finally, the AVEs of the NTMs and TABs calculated for each product are added to the tariffs of the products. The resultant figure represents the total tariff equivalent imposed by each import partner (*i*) on a product (*h*) exported to them by country (*j*) (refer to equation (1).

The following section provides the details of each of the steps mentioned above.

Obtaining the partner import demand elasticity

Import demand elasticities measure the sensitivity of imports to variations in import prices. It is calculated as a per cent variation in the quantity of imported products due to a one per cent change in the imported product's price. United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP)[4] provides estimates of import demand elasticities for all traded products covering over 180 countries at the six-digit level of the 2012 harmonized system (HS). The thesis uses these estimates as import demand elasticities required for obtaining the AVEs of NTMs and TAB components.

Estimating the Effect of Non-Tariff Measures and Trading Across Border Barriers

In the next stage, a gravity model is used to quantify the impact of NTMs and TABs on the import of a country. The following gravity framework of Kee et al. (2008) is used for this.

[4] https://www.unescap.org/resources/new-global-estimates-import-demand-elasticities-technical-note

$$ln\, m_{ijht} = \beta_{0h} + \beta_{1h}\, ln\,(1 + T_{ijht}) + \beta_{2h} NTM_{ijht} + \beta_{3h} TAB_{ijht} + \beta_{4h} C_{ijt} + w_{ijh} + w_{ht} + \varepsilon_{ijht} \quad (2)$$

Where, m_{ijht} is the import of product *h* to destination country *i* from the source country *j* at time *t*; β_{oh} represents the product specific fixed effect; T_{ijht} is the ad valorem tariff rate imposed by the destination country *i* on *h* imported from the source country *j*. β_{1h} captures the impact of tariff imposed on the imports; NTM_{ijht} is the count variable of non-tariff measures and β_{2h} is the coefficient which captures the impact of NTMs imposed by importer *i* on good h imported from partner country *j*. TAB_{ijht} is the variable that captures the trade-weighted border and documentary compliance requirements imposed by country *i* on its imports, the trade weights being the share of country *j* in total imports of a product *h* by country *i*. Hence β_{3h} is the coefficient corresponding to TAB at country *i* that is experienced when good *h* is imported from country *j*; C_{ijt} is the time-dependent country-pair characteristics and comprises of the classical gravity variables and factors that include endowments. These are listed as follows:

- traditional market potential of trade partners represented by summation of both countries' GDP: $Y_{ijt} = ln(GDP_{it} + GDP_{jt})$.
- economic development distance based on GDP and GDP per capita (GDP_{PC}) of partners as used by Baltagi et al. (2003):

  $$Y_{ijt} = \{ \frac{GDP_{it}^2}{(GDP_{pcit} + GDP_{pcjt})^2} + \frac{GDP_{it}^2}{(GDP_{pcit} + GDP_{pcjt})^2} - \frac{1}{2} \}$$

- distance between the trading partners in relation to three-factor endowments relative to GDP, namely land area A, labour L and capital stock K.
- dummy variables – one, signifying if *i* and *j* are WTO partners and second, capturing the prevalence of a Preferential Trade Agreement (PTA) between country *i and j.*

There are no time-invariant country-pair variables (e.g., whether countries are geographically adjacent, share a common language, or have a common colonial history) included in equation (2). The country pair fixed effects w_{ijh} included in the equation accounts for these. w_{ht} represent the time fixed effects and ε_{ijht} is the error component.

Deriving AVEs for NTM and TAB and calculating total tariff equivalents

The value of the coefficients β_{2h} and β_{3h} estimated from equation (2) is noted down. Thereafter, these coefficients are combined with the import demand elasticities as obtained earlier, and the tariff equivalents of the NTMs and the TAB applied by each importing country are obtained. The AVEs of NTMs (equation 3) and TAB (equation 4) applied by country *i* on its import of commodity *h* is then calculated as follows:

$$\frac{\delta ln\,(m_{ih})}{\delta NTM_{ih}^{n}} = \frac{\delta ln\,(m_{ih})}{\delta lnP_{ih}} \frac{\delta ln\,(P_{ih})}{\delta NTM_{ih}^{n}} = \varepsilon_{ih}\; AVE_{ih}^{NTM}$$

$$\text{Or, } AVE_{ih}^{NTM} = \frac{e^{\beta 2h} - 1}{\varepsilon_{ih}} \qquad (3)$$

$$\text{And, } \quad \frac{\delta ln\,(m_{ih})}{\delta TAB_{ih}^{n}} = \frac{\delta ln\,(m_{ih})}{\delta lnP_{ih}} \frac{\delta ln\,(P_{ih})}{\delta TAB_{ih}^{n}} = \varepsilon_{ih}\; AVE_{ih}^{TAB}$$

$$\text{Or, } AVE_{ih}^{TAB} = \frac{e^{\beta_{3h}} - 1}{\varepsilon_{ih}} \qquad (4)$$

In deriving each of the equations (3) and (4), P_{ih} represents the price for product *h* imported by country *i*. After calculating the tariff equivalents of NTMs and TAB for each product in a country across different periods, as outlined in equations (3) and (4), they are combined with the tariffs imposed by the country on each specific product. This yields the figure for the total tariff equivalent for each product in each country at a particular time (as in equation (1)).

The empirical application of the methodology described in this section focuses on India's exports of its top twenty commodities (at the two-digit Harmonized System 2002 level) and its top twenty-five export destinations as of 2018. At the six-digit HS classification, this encompasses 2,363 commodities for the period 2002–2018. The data required for solving the set of equations (1 – 4) are sourced from the following five databases: World Development Indicators (WDI)[5], WITS database, Penn World Tables[6], World Bank's Ease of Doing Business

[5] https://data.worldbank.org/indicator

[6] https://www.rug.nl/ggdc/productivity/pwt/?lang=en

Reports[7] and WTO's Integrated Trade Intelligence Portal (I-TIP)[8] database. The data with corresponding sources are detailed in Table 4.

Table 4: Details of Data and Sources

Variables	**Data**	**Source**
For import demand elasticity		
$Epsilon_{hit}$		United Nations Economic and Social Commission for Asia and Pacific
For Gravity model in equation (4.2)		
m_{ijht}	Import from India by trade partners	WITS database
T_{ijht}	Applied tariffs imposed by trade partners on Indian exports	WITS database
NTM_{ijht}	NTMs applied by trade partners on Indian exports	WTO I-TIP database - NTMs applied to Indian products were captured to create a separate database of NTMs implemented exclusively against India.
TAB_{ijht}	Time taken to import	– Calculated from "Trading Across Borders' component of Ease of Doing Business.
C_{ijt}	GDP, Population, agricultural land of trade partner, Preferential trade agreement with trade partner	World Development Indicators, Ministry of Commerce, Government of India.

Source: Author's compilation

[7] https://www.doingbusiness.org

[8] https://i-tip.wto.org

Table 5: Top 25 import partner-wise Tariff, AVE of NTMs and AVE TABs during 2002-2018

Import Partners	Average tariff (%)	Average AVE TAB (%)	Average AVE NTM (%)	Average DBRI (%)
Advanced Countries				
Belgium	5.8	3.7	-50.7	-41.3
France	5.2	4.8	-49.5	-39.5
Germany	4.4	3.9	-29.4	-21.1
Hongkong, China	1.0	5.7	-30.1	-23.4
Italy	4.6	4.5	-74.0	-65.0
Japan	2.7	5.6	35.1	43.4
Korea, Republic	6.4	4.3	4.2	14.9
Netherlands	5.3	5.2	-92.5	-82.0
Singapore	0.7	5.4	80.6	86.6
Spain	5.6	5.4	-135.3	-124.2
United Kingdom	4.4	3.8	1.0	9.2
United States	3.1	3.4	-37.2	-30.7
Average	**4.1**	**4.6**	**-31.5**	**-22.8**
Developing Countries				
Bangladesh	8.4	1.0	153.3	162.7
China	5.4	5.3	45.2	55.9
Indonesia	2.6	2.7	165.4	170.6
Malaysia	4.3	4.2	77.7	86.2
Mexico	8.9	6.2	-48.4	-33.3
Nepal	6.5	0.8	146.8	154.1
Saudi Arabia	2.0	1.6	124.2	127.7
South Africa	9.6	1.0	72.5	83.2
Sri Lanka	2.0	1.0	188.4	191.7
Thailand	3.1	3.2	21.2	27.5
Turkey	2.1	3.6	34.1	39.7
United Arab Emirates	2.6	1.4	50.7	54.6
Vietnam	3.9	2.2	170.5	176.5
Average	**4.7**	**2.6**	**92.4**	**99.8**

Source: Based on Author's calculation

A commodity-level analysis of the export basket (refer to Table 5) reveals that commodities in general have attracted higher restrictions on account of NTMs. But at the same time, the AVEs of NTMs for individual products have ranged from negative to positive values suggesting both trade facilitating and trade restricting effects on Indian exports. Technical barriers specifically

have been found to facilitate import (Ghodsi and Stehrer, 2016) as trading countries usually use these measures to ensure better quality and information to consumers. Conversely, sanitary, and phytosanitary measures applied on primary products are more import-restricting in nature. However, some products like mineral fuels, chemicals, plastics, tanning and dyeing extracts, pearls and precious and semi-precious stones, ships, boats, electrical machinery, and vehicles attract such high positive NTMs resulting in significantly high overall restrictive impact of NTMs on Indian exports. Many of the commodities attracting high NTMs like chemicals, dyes, machinery, ships, boats, textiles and wearing apparel also experience major TAB restrictions. These commodities are exported to both developed and developing countries. In developed countries, they are subject to stringent quality standards, while in developing countries, they face heightened obstacles due to inadequate infrastructure, cumbersome customs procedures, and ineffective trade facilitation measures.

The positive and negative AVEs of NTMs and TABs aside, an important observation from figures in tables 5 and 6 are the substantially high absolute values of the AVEs. Such high NTM values align with those reported in the UNCTAD database, which provides ad valorem equivalents of NTMs imposed by importing countries at the six-digit Harmonized System product level (UNCTAD, 2020) and those mentioned by Ghodsi and Stehrer (2016). The latter constrained the AVEs to 100 in absolute terms suggesting that intuitively NTMs that work as subsidies cannot reduce the price of an imported product by more than 100 per cent.

Table 6: Top Commodity-wise Tariff, AVE of NTMs and AVE TABs (2002-2018)

Commodities	Average Tariff (%)	Average AVE NTM (%)	Average AVE TAB (%)	Average BRI (%)
Aluminium and its articles	5.2	-50.2	0.06	-44.97
Articles of iron or steel	4.1	-42.5	0.02	-38.4
Cereals	16.96	-7.9	0.00	9.05
Cotton	6.4	-79.9	0.00	-73.5
Electrical machinery	2.6	329.3	0.01	331.9
Iron and steel	1.9	-32.4	0.00	-30.6
Knitted Apparels	10.9	-950.1	0.71	-938.5
Machinery, mechanical appliances, boilers and nuclear reactors	0.04	1.2	2.17	3.4

Commodities	Average Tariff (%)	Average AVE NTM (%)	Average AVE TAB (%)	Average BRI (%)
Mineral Fuels	3.1	89.9	0.00	93.02
Miscellaneous chemical products	3.3	310.9	0.00	314.2
Non-knitted Apparels	11.0	-122.5	0.00	-111.5
Organic Chemicals	11.5	109.5	40.1	161.2
Pearls, precious or semi-precious stones and metals	1.7	735.1	0.10	736.9
Pharmaceutical Products	1.4	2.00	0.00	3.4
Plastics and its articles	5.2	272.9	0.00	278.1
Ships and boats	1.8	1540.1	0.32	1542.2
Tanning and Dyeing extracts	3.7	95.4	32.1	131.2
Textiles	9.3	0.01	0.21	9.5
Vehicles other than railway	12.7	160.04	0.01	172.8
Fish and Crustaceans	5.1	-26.5	0.00	-21.4

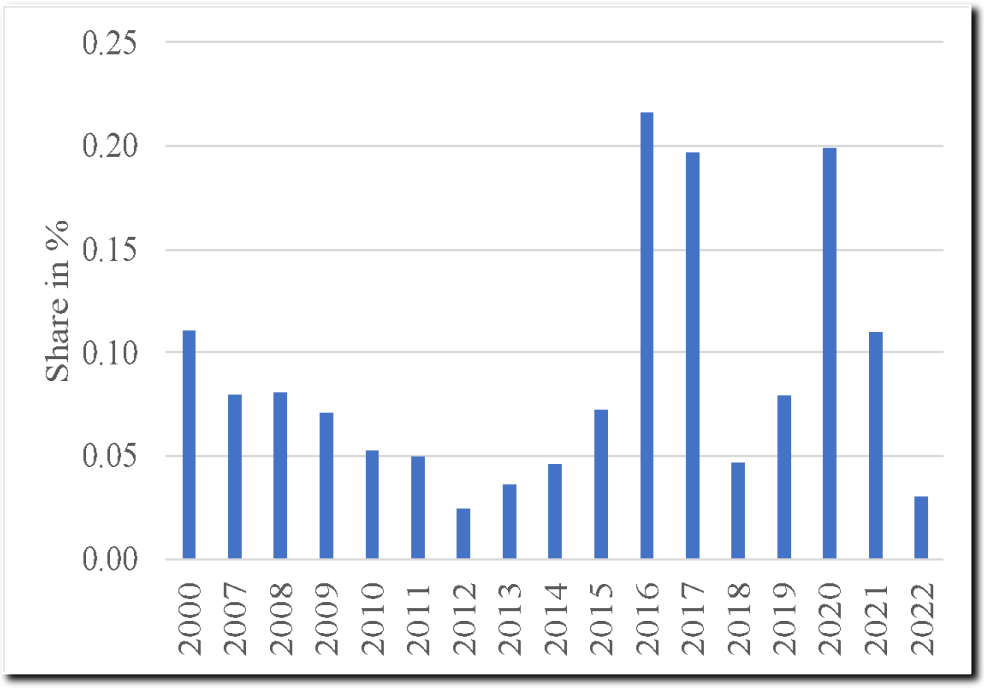
Source: Based on Author's calculation

7.2 Assessing the Indirect Measure of Trade Restrictiveness on India's import partners

Given the structure of the global trade currently, a country can participate in global value chains (GVCs) in two key ways. One is through backward GVC participation, which involves importing intermediate goods to produce goods and services for export. This is measured by the ratio of foreign value added to gross exports. The other is forward GVC participation, where a country exports domestically produced intermediate goods to partner countries responsible for downstream production stages. This is measured by the ratio of domestic value added in exports to third countries relative to gross exports (Koopman et al., 2010; 2014).

India's total GVC participation was 36.4 per cent in 2018 of which 19.8 was backward participation and 16.5 per cent was forward participation (Chawla and Kumar, 2023). India demonstrates considerable GVC participation, representing 2.7 per cent of the global GVC output and 3.5 per cent of its total output. For this study, the focus is on India's forward GVC participation. Figure 7 presents the data on India's total GVC participation for the period 2000 – 2022.

Figure 7: India's share in GVCs during 2000 - 2022



Source: Author's calculations based on WITS data

Figure 7 highlights the dynamic nature of India's involvement in GVCs, marked by periods of growth and decline, reflecting the complexities and challenges of global trade integration. From an initial participation rate of 0.11 in 2000, there was a gradual decline to 0.05 by 2011, reaching a low of 0.02 in 2012. Following this, participation rates fluctuated with a notable peak in 2016 at 0.22, the highest during the above period. The subsequent years show variability, with another peak in 2020 at 0.19 per cent, but this was followed by declines to 0.10 per cent in 2021 and 0.03 in 2022.

As discussed in the previous section on DBRI, when a country *i* imposes a direct bilateral trade restriction as measured by DBRI on a specific product *h* imported from country *j*, the price of the imported product in country *i* increases by $DBRI_{ijht}$. The domestic producers in sector *h* of the importing country *i* benefit from the DBRI, as the increased import prices reduce competition for the import-competing industry. But the downstream domestic sectors in country *i,* which use the imported product *h* as input, now face higher input prices and thereby bear additional costs due to the DBRI. Thus, there is an indirect cumulative bilateral trade restrictiveness which is the costs to the producers along the later stages of production which use the imported product *h* (subject to the DBRI) as inputs (Miroudot et al. (2013). The IBRI

paid to produce one unit of good *s* in country *i* using good *h* imported from country *j* is thus given as follows:

$$IBRI = \sum_{jh} a_{jhis}\, DBRI_{ijh} \qquad (5)$$

where a_{jhis} is the technical coefficient of sector *s* in country *i* that uses the product of sector *h* imported from country *j* as inputs. and BRI_{ijh} is the imposed DBRI on sector *h* in exporting country *j*.

The cumulative IBRI for all downstream importing countries along the global value chain can be written as:

$$\sum_{xz} \sum_{jh} a_{jhis}\, BRI_{ijh} a_{isxz} BRI_{xis} \qquad (6)$$

where a_{isxz} is the output of sector *z* from country *x* that uses the product of sector *s* from country *i* as inputs.

In this study, the IBRI figures are calculated for only one downstream country, i.e., the importing country (India's import partner, denoted as *i*) that imposes the bilateral trade restriction on the exporting country (India, denoted as *j*). However, the modern global economy has most often been characterized by long and complex supply chains that span across multiple countries. In such cases, DBRI imposed on a particular country's exports is likely to have a large cumulative impact on all downstream countries.

For constructing the IBRI faced by the downstream firms in the importing country *i*, the technical coefficient (a_{jhis}) of sector *s* in country *i* that uses a product of sector *h* imported from country *j* as inputs are required. This is calculated based on input-output data for the importing country obtained from the GTAP database version 10. (Global Trade Analysis Project, Purdue University). This database, which provides data for the world economy as of 2004, 2007, 2011, and 2014, is compiled for bilateral exports, imports, and tariffs, inclusive of other flows, for 121 countries across the world (that covers 98 per cent of world GDP and 92 per cent of the world population) and for 65 tradable commodities of the world.

The present study aggregates this database based on India's top twenty export products and top twenty-five partners for the respective years. The input-output tables and corresponding technical coefficients are available from the GTAP database for the base years 2004, 2007, 2011, and 2014. The data available for 2004 is used for years 2002-2005, that available for

2007 is used for years 2006–2009; that available for 2011 is used for years 2010–2013; and finally, the data available for 2014 is used for all years from 2014 to 2018. This assumes that technologies as represented by input-output coefficients in the input-output coefficient matrices do not change year on year. The input-output tables for countries across the world are not available at Harmonized System commodity classification of trade. Therefore, when calculating the IBRI, the disaggregated commodity data (at the two-digit Harmonized System 2002 classification) used to derive the DBRI in the study is aggregated and mapped to the commodity classification used by the GTAP database based on the available concordance table (Aguiar, 2016). Thus, the study reports the DBRI at HS two-digit disaggregated commodity classification but reports the IBRI at an aggregated level as per sectoral data available in the GTAP database.

Table 7: Year-wise Direct, Indirect and Total Bilateral Trade Restrictiveness Index values for the Top 25 destinations across the top 20 sectors (in per cent)

Trade Year	DBRI	IBRI	TBRI
2002	-1.0	1.3	0.3
2003	29.7	4.5	34.2
2004	24.7	1.4	26.1
2005	14.9	0.9	15.8
2006	25.1	1.5	26.6
2007	22.1	1.4	23.4
2008	17.1	1.4	18.5
2009	33.7	5.1	38.8
2010	56.2	4.5	60.7
2011	41.2	4.6	45.8
2012	52.2	4.3	56.4
2013	67.3	3.8	71.1
2014	41.8	4.6	46.4
2015	56.5	4.3	60.7
2016	43.0	4.3	47.3
2017	30.8	4.3	35.1
2018	23.7	0.8	24.5
Average	**36.1**	**3.3**	**39.3**

Source: Author's own calculations

Table 8: Top 25 Destination-wise DBRI, IBRI and TBRI during 2002-18 across top 20 sectors (in per cent)

Partner	DBRI	IBRI	TBRI
Developed countries			
Belgium	-41.3	-2.7	-43.9
France	-39.5	-2.3	-41.8
Germany	-21.1	-0.7	-21.8
Hong Kong	-23.4	0.02	-23.4
Italy	-65	-1.3	-66.3
Japan	43.4	0.05	43.4
Korea, Republic	14.9	-0.2	14.7
Netherlands	-82	-0.9	-82.9
Singapore	86.6	0.4	87.1
Spain	-124.2	-1.2	-125.4
United Kingdom	9.2	-1	8.2
United States	-30.7	-0.4	-31.1
Average for Developed countries	**-23.2**	**-0.8**	**-24.0**
Developing countries			
Bangladesh	162.7	0.2	162.9
China	55.9	0.1	56.0
Indonesia	170.6	0.9	171.5
Malaysia	86.2	0.4	86.6
Mexico	-33.3	-0.6	-33.9
Nepal	154.1	63.1	217.2
Saudi Arabia	127.7	0.5	128.2
South Africa	83.2	0.2	83.4
Sri Lanka	191.4	18.5	209.9
Thailand	27.5	0.1	27.6
Turkey	39.7	0.4	40.2
United Arab Emirates	54.6	2.5	57.1
Vietnam	176.5	0.6	177.2
Average (Developing countries)	**100.1**	**7.7**	**177.2**
Overall Average (All countries)	**36.1**	**3.3**	**39.3**

Source: Author's calculations

Since the IBRIs presented in Tables 7 and 8 reflect restrictions affecting only one downstream country (India's import partner), the reported figures are relatively low. In cases of global value chains-based international trade transactions, a DBRI imposed on a specific country's exports

can significantly amplify trade restrictions across all downstream countries in the supply chain. As a result, the cumulative IBRI figures, which account for these broader effects, are expected to be much higher than those reported in Tables 7 and 8.

The IBRI experienced by India's import partners ranges from 0.8 to 5.1 per cent, as shown in Table 7, with the overall average for the top twenty-five partners during the study period standing at 3.3 per cent. While this average may appear modest, certain partners report higher values, particularly developing countries such as Nepal and Sri Lanka. Even though the IBRI for the UAE is below the average, it remains relatively significant (Table 8). Developed countries typically exhibit lower IBRI values, often negative, reflecting the underlying negative DBRI, which indicates a trade-promoting rather than trade-restricting impact on India. Among the developed countries, the Asian countries of Japan, Hongkong, and Singapore experience indirect trade restrictiveness due to the DBRI they impose on Indian exporters.

The magnitude of IBRI experienced by countries in particular years and, hence, the overall average IBRI for a country over the years is explained by

a. the DBRI ($DBRI_{ijh}$) experienced by a country's exporters of specific products to the partner country in that year or over the years – the higher the DBRI, the higher the IBRI.

b. the forward linkages of exported goods as measured by the technical coefficient (a_{jhis}) – The stronger the forward linkages of Indian exports to the importing country or the stronger the backward linkages of the importing country's sectors to Indian sectors, the greater the IBRI. The strength of this linkage may be measured by the share of intermediate goods imported by the partner - the higher the import share of intermediate goods compared to final goods, the higher the overall IBRI for the country.

c. the DBRI is attracted by the goods in the export basket from the exporting country to the partner country.

Table 9 reports information related to the share of intermediate imports from India by the partner countries, the DBRI on India due to trade restrictions imposed by these countries and the corresponding IBRI. The data in Table 9 indicates that a significant portion of imports from India by both developed and developing partners are used to meet their intermediate goods requirements for further production processes. For developed countries, this share ranges from 14.2 per cent to 79.6 per cent, while for developing countries, it ranges from 14.4 per cent to

69 per cent. In developing countries, DBRIs are typically high and positive, reflecting the price-increasing effects of their trade restrictions on India. In contrast, most developed countries exhibit a net trade-promoting effect on India, as indicated by the negative DBRI values associated with these partners.

For developing countries, the overall high positive DBRIs, combined with a substantial share of intermediate imports, result in positive IBRIs for import partners. Nonetheless, certain individual products within the export baskets to these countries experience negative DBRIs, reflecting the trade-enhancing effect that they experience. The magnitude of the positive IBRI depends on the relative share of such products in the export basket. For instance, consider Bangladesh and Indonesia on one side and Nepal and Sri Lanka on the other. While all four countries import a large share of intermediate goods from India and impose similarly high positive DBRIs, the magnitudes of their IBRIs differ. Bangladesh and Indonesia experience relatively low IBRIs, whereas Nepal and Sri Lanka face significantly higher IBRIs. This difference stems from the specific DBRIs associated with the goods imported by each group of countries.

For developed countries, the predominantly high negative DBRIs result in negative IBRIs, reflecting the price-reduction benefits they derive from their trade restrictions on Indian exporters. However, Hong Kong, Korea, and the United Kingdom deviate from this trend. In the case of Hong Kong, despite an overall negative DBRI, the IBRI is positive due to the relatively high share of intermediate goods with positive DBRIs. Conversely, for Korea and the United Kingdom, although their overall DBRIs are positive, the net IBRIs are negative because individual goods with negative DBRIs dominate their import baskets.

Thus, the share of intermediate goods in total imports, the extent of the DBRI, the composition of goods in the import basket, and the product-level DBRIs collectively determine the magnitude of the IBRI faced by import partners.

Table 10 presents the tariffs and AVEs of non-tariff measures and trade across border restrictions corresponding to the IBRIs of the partners. Since NTMs constitute the largest component of DBRIs, they also contribute the most to the IBRIs.

Table 9 - Analysis of India's top import partners across the top 20 sectors and corresponding import barriers in 2018

Partner	Share of intermediate goods in imports from India (%)	DBRI	IBRI
Developed countries			
Belgium	62.6	-41.3	-2.7
France	20.4	-39.5	-2.3
Germany	25.1	-21.1	-0.7
Hong Kong	79.6	-23.4	0.02
Italy	48.6	-65.0	-1.3
Japan	42.4	43.4	0.05
Korea, Republic	55.6	14.9	-0.2
Netherlands	24.8	-82.0	-0.9
Singapore	14.1	86.6	0.4
Spain	39.6	-124.2	-1.2
United Kingdom	17.3	9.2	-1.0
United States	30.5	-30.7	-0.4
Developing countries			
Bangladesh	41.0	162.7	0.2
China	68.9	55.9	0.1
Indonesia	48.8	170.6	0.9
Malaysia	36.2	86.2	0.4
Mexico	31.7	-33.3	-0.6
Nepal	31.3	154.1	63.1
Saudi Arabia	23.2	127.7	0.5
South Africa	14.4	83.2	0.2
Sri Lanka	33.4	191.4	18.5
Thailand	48.0	27.5	0.1
Turkey	34.0	39.7	0.4
United Arab Emirates	56.5	54.6	2.5
Vietnam	36.1	176.5	0.6

Source: WTO and author's calculation

Table 10 - Top 25 Destination-wise IBRI break-up values across the top 20 sectors during 2002-18 (in per cent)

Partner	Average IBRI due to Tariff	Average IBRI due to NTM	Average IBRI due to TAB	Average IBRI
Bangladesh	0.18	0.01	0	0.2
Belgium	0.07	-2.77	0.02	-2.7
China	0.01	0.07	0.01	0.1
France	0.04	-2.36	0.01	-2.3
Germany	0.03	-0.72	0.02	-0.7
Hong Kong	0	0.01	0.01	0.02
Indonesia	0.01	0.86	0.01	0.9
Italy	0.03	-1.34	0.01	-1.3
Japan	0.01	0.03	0.01	0.05
Korea, Rep.	0.02	-0.23	0.02	-0.2
Malaysia	0.03	0.35	0.03	0.4
Mexico	0.02	-0.62	0.01	-0.6
Nepal	2.12	60.75	0.27	63.1
Netherlands	0.03	-0.98	0.01	-0.9
Saudi Arabia	0.01	0.45	0.01	0.5
Singapore	0.01	0.4	0.04	0.4
South Africa	0.03	0.14	0	0.2
Spain	0.03	-1.23	0.02	-1.2
Sri Lanka	0.18	18.24	0.09	18.5
Thailand	0.01	0.07	0.02	0.1
Turkey	0.02	0.36	0.04	0.4
United Arab Emirates	0.06	2.39	0.04	2.5
United Kingdom	0.03	-1.01	0.01	-1
United States	0.01	-0.4	0.01	-0.4
Vietnam	0.02	0.62	0.01	0.6
Average	**0.12**	**3.1**	**0.03**	**3.3**

Source: Author's calculations

The results in this chapter indicate that (i) the adverse impact of trade restrictions imposed on Indian exporters by its import partners does not remain limited to Indian exporters. They have negative implications for the importers themselves as represented by the indirect restrictiveness

index (ii) the overall indirect trade restriction (3.3 per cent) reported is much smaller compared to direct trade restrictiveness (36.1 per cent) on the exporter, yet they have consistently been experienced by most of the import partners and over the entire period of the study (iii) the respective shares of tariff, non-tariff and trading across border requirements in total indirect trade restrictiveness are approximately 4 per cent, 95 per cent and 1 per cent (iv) the IBRI concerning an import partner is collectively determined by the share of intermediate goods in total imports, the extent of DBRI faced by the exporter, the composition of goods in the export basket, and the product-level DBRIs.

7.3 Assessing the Macroeconomic and welfare implications of trade barriers

This section is dedicated to examining the research objective (3) i.e. to investigate the economy-wide impact of direct trade restrictiveness on the exporting country and indirect trade restrictiveness on the importing country.

One of the most widely used techniques for quantitative analysis in trade is the Computable General Equilibrium (CGE) model (Hansen and Scarf, 1973). These models, which effectively integrate economic linkages within and between countries, perform ex-ante analyses of potential policy impacts. This study employs the CGE modelling framework of the Global Trade Analysis Project (GTAP), which is one of the most popular CGE models in use today. The Global Trade Analysis Project (GTAP) is an international network of scholars and decision-makers who analyse international trade issues quantitatively. There are two essential parts of GTAP:

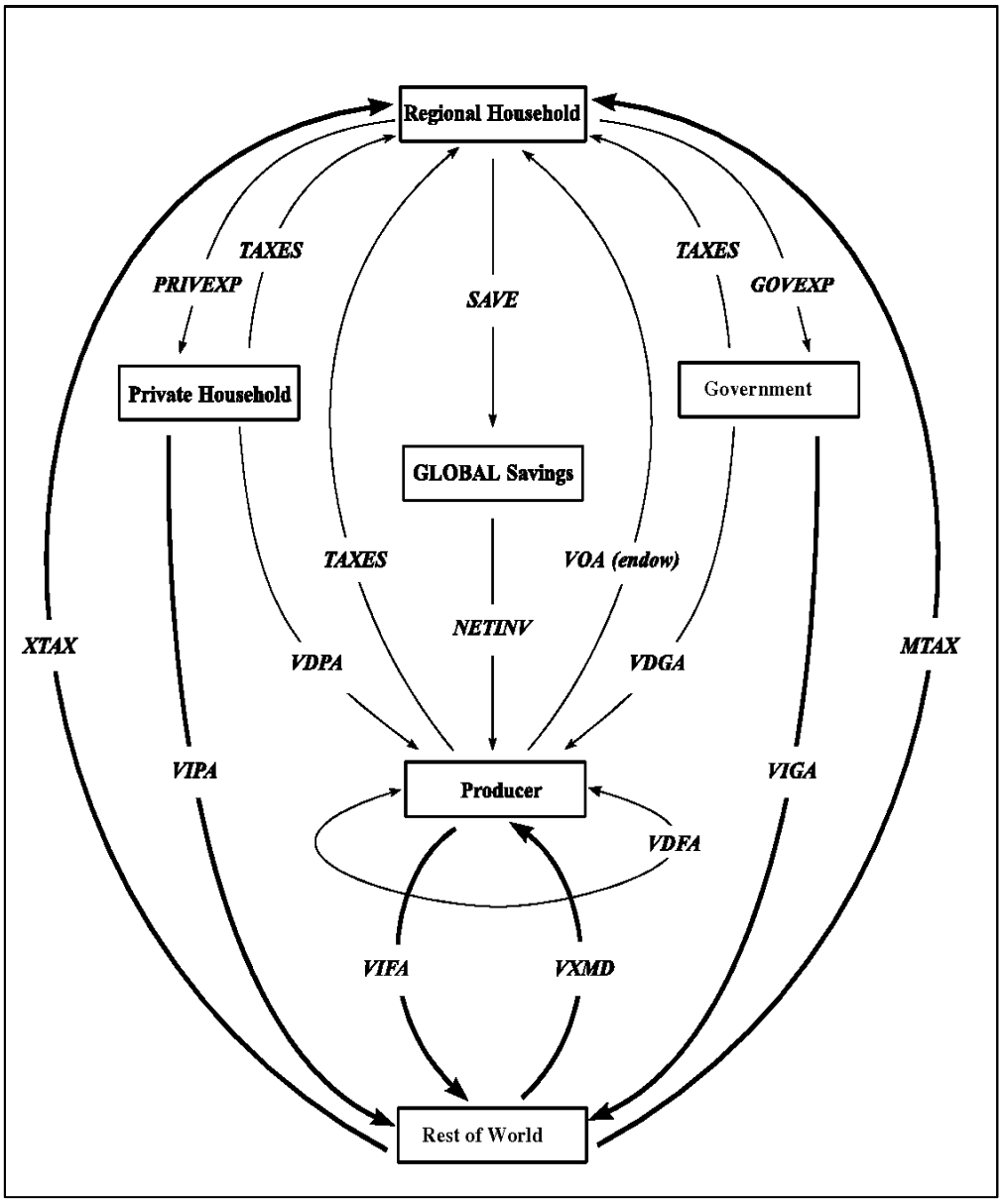
- A CGE model known as the GTAP Model.
- The GTAP Data Base, which serves as the foundation for the GTAP Model

Developed by T.W. Hertel in 1997 (Hertel, 1997), the GTAP model is a multi-region, multi-sector computable general equilibrium model that represents global economic activity in many sectors across several locations. There has been an increase in the number of sectors and regions included in the database since its initial release in 1993. As per a CGE framework, the GTAP model consists of the following agents:

i. Household; ii. Government; iii. Producers; and iv. Abroad

Figure 8 presents a graphical description of the GTAP model.

Figure 8 - A Graphical Exposition of the GTAP Model



Source: Brockemeier, 2001

Household

1. Households provide factor services to firms and receive as payments the value of the output (VOA) they contribute. This constitutes their primary source of income, which is allocated towards consumption and savings.
2. Private household expenditure (PRIVEXP) on consumption is directed towards both domestic products (value of domestic private household purchases (VDPA) and imported goods (VIPA). The Savings (SAVE), on the other hand, are channelled back to producers

for investment purposes (NETINV). Further, households pay taxes to the government and may also receive subsidies. The difference between the taxes paid and subsidies received is referred to as net taxes, denoted as (TAXES*)*.

Government

1. The government acquires income through levies imposed on the consumption and production of both domestic and foreign commodities.
2. Government expenditure (GOVEXP) is earmarked towards the purchase of goods and services, consequently adding to the demand for goods and services sold by domestic firms (value of domestic government purchases, VDGA), as well as imports of goods (VIGA). It also gives out subsidies.
3. The Private Household and the Government constitute the Regional Household in the GTAP framework. It is a collective unit responsible for the ownership of production elements, levying taxes on other entities such as firms and activities, and making decisions regarding consumption expenditure. It distributes funds towards private consumption (PRIVEXP), public consumption (GOVEXP), and savings (SAVE). The latter are subsequently deposited in international financial institutions, where the global bank supports investment activities (NETINV).

Producer

1. The Producers earn revenue by selling finished goods and services to private domestic households (VDPA), to the government (VDGA), intermediate goods to domestic producers (VDFA) and intermediate and final goods to foreign producers and consumers (VXMD). The other two sources of their fund inflow are subsidies from the government and finances for investment from global banks.
2. The firms use the revenue from sales, subsidies and borrowings to rent factors of production (VOA), to buy domestic intermediate inputs (VDFA) and foreign intermediate inputs (VIFA), and to pay taxes to the government.

Welfare Measurement in the GTAP Model

In the GTAP framework, the estimation of welfare change involves calculating the percentage change in per capita utility within a specific region due to distortions such as a policy shock.

This change is specified over per capita private household consumption, per capita government spending, and per capita savings. The quantification of welfare change is presented in US Dollars (USD) million. A policy shock, such as a trade liberalization or trade restriction, is likely to result in welfare change due to the reallocation of production resources and changes in terms of trade and employment. Accordingly, the total welfare effect in the GTAP model is categorized into three components – allocative efficiency effect, endowment effect and terms of trade effect.

Allocative efficiency gains are realized through improved allocation of resources towards more productive uses. Essentially, an increase in activities that are relatively taxed signifies a positive impact on welfare as it facilitates the reallocation of resources towards socially beneficial purposes. This principle applies to both commodities and endowments, as well as to traded goods. Goods that generate trade taxes contribute to the overall benefits of the economy. The terms of trade for a region are determined by the ratio of the region's export price index to its import price index. Thus, an increase in export prices compared to import prices following a policy shock has a favourable impact on the region's welfare. Similarly, the endowment effect, which reflects changes in the utilization of production factors, can enhance welfare if the altered employment patterns lead to an increase in the economy's productive capacity (Sikdar and Mukhopadhyay, 2017).

The simulations conducted using the GTAP model, based on the CGE framework, entail the examination of comparative static results. This involves analysing the effects of adjustments in exogenous parameters on the distribution of resources among productive activities along with the finished goods among the consumers, as well as the resulting implications for economic well-being. Therefore, the selection of exogenous variables within the GTAP model should be made initially, considering the perturbations one wishes for any economy, economies, or region to undergo. Following the identification of the set of exogenous variables and the application of shocks to these selected variables, the model functions to present outcomes that compare different equilibrium conditions - one before the shock and one after it. The outcomes of the simulations, which involve various shocks, are interpreted as representing how the economic system under analysis might appear if the shock, typically a policy measure, occurs in the reference year.

GTAP Database

The comprehensive global dataset of GTAP integrates detailed bilateral trade flows, transport costs, information on tariff and non-tariff barriers and all other data that are in the social accounting matrices (SAM). The regional input-output tables that underlie the database are provided by the respective regions, while other data sources include various databases such as the World Bank[9] for macroeconomic data, United Nations Comtrade[10] database for trade data, World Bank World Integrated Trade Solution (WITS)[11] database and ITC MAcMap[12] for tariff data.

The database used for CGE modelling in the current research is version 10 of the GTAP database which includes four alternative base years – 2004, 2007, 2011 and 2014. The database is compiled for bilateral exports and imports and tariffs inclusive of other flows for 121 countries of the World and 65 tradable commodities. The present study aggregates these 121 regions into 27 countries including India, its top 25 import partners and the rest of the world (ROW). The 65 sectors are aggregated into 10 sectors which cover India's top 20 exports.

The impact of trade restrictiveness is calculated for five select years – 2004, 2007, 2011, 2014 and 2018. While the database includes data for the first four years, the 2018 data is derived by updating the 2014 database through macroeconomic shocks, which involve adjusting the values of key macroeconomic variables using the Altertax[13] feature of GTAP to apply shocks to macroeconomic variables such as GDP, population, labour, and capital. This method is well-documented in the literature (Boulanger et al. (2016) and Diffenbaugh et al. (2012)).

The study utilizes the GTAP model and its underlying database to analyse both the direct and indirect macroeconomic and welfare implications of shocks caused by tariffs, non-tariff measures (NTMs), and trading across border barriers (TABs) imposed by trading partners on Indian exporters. The standard GTAP model assumes full employment in factor markets. However, this assumption does not reflect the reality, especially for unskilled labour in developing countries. To better capture real-world conditions, this study modifies the standard

[9] https://data.worldbank.org/
[10] UN Comtrade
[11] https://wits.worldbank.org/
[12] https://www.macmap.org/
[13] https://www.copsmodels.com/webhelp/rungtap/index.html?hc_altertax.htm

GTAP model by replacing the full employment assumption with one of unemployment for the unskilled labour force in all developing countries under consideration.

Evaluating the direct impact of trade restrictiveness on welfare and macroeconomic variables of the exporting country India

This section presents the evaluation of the direct impact of trade restrictiveness on the exporters from India. To do this, the study carries out four simulations using the GTAP model, each simulation calibrated to different scenarios involving India's exports to its partners. The scenarios simulated involve the following shocks:

- Simulation I: Shocks to a bilateral tariff imposed by top importers on Indian top exports. The tariff shocks are based on total BRIs. This simulation represents the scenario that involves the Indian exporters facing the total restrictions as estimated based on the sum of tariffs and AVEs of NTMs and TABs (as estimated using the methodology described in the previous section).
- Simulation II: Shocks to the bilateral tariff imposed by importers on Indian exports. The simulated scenario focuses solely on exporters subjected to the tariff shock. Accordingly, the shocks are based on import tariffs imposed by partners as collected from the WITS database and detailed in the DBRI section.
- Simulation III: Shocks to bilateral NTMs imposed by importers of Indian goods. The shocks are based on the AVEs of NTMs estimated using the methodology described in the previous section. This simulation represents a scenario where Indian exporters face restrictions solely due to NTMs.
- Simulation IV: Shocks to trade costs at importers' border faced by Indian exporters, presented as TAB in the DBRI section. The shocks are based on the AVEs of TABs estimated using the methodology elaborated in the earlier sections. The simulation involves a scenario wherein exporters face only TAB restrictions.

The simulated scenarios I - IV are grounded in a comprehensive analysis of trade restrictions faced by Indian exporters. The exogenous shocks applied in the base model in each of the four simulations are incorporated into the model as an import tariff shock, where the top import partners are the importing countries, and India is the exporter. For each of these importing countries, the shocks are applied with respect to tariffs on the ten commodities. Each of the four simulations mentioned above is conducted for five years – 2004, 2007, 2011, 2014 and

2018. The simulation results related to the macroeconomic impact on India are reported in Table 11.

The analysis of the simulation results highlights the trade restrictions experienced by various exporting sectors in India over the years. Heavy manufacturing has faced restrictions due to a combination of tariffs, non-tariff measures (NTMs), and trading across border barriers (TABs). In contrast, light manufacturing has primarily dealt with non-tariff restrictions, while meat and livestock have only been subject to restrictions due to TABs. Other sectors, including grains, crops, fishing, forestry, extraction, textiles, and apparel, have been exclusively impacted by tariffs.

Despite the variation in restriction types, the overall effects on output and employment have been consistent across sectors and time. These restrictions have led to declines in exports, output, and employment (refer to Table 11). Among production factors, natural resources have been the least affected, while skilled labour and capital have been the most impacted. This is largely due to the heavy reliance on these two factors in manufacturing, one of the sectors most severely impacted by trade restrictions.

In terms of total BRI, light manufacturing is the most affected with respect to exports, output, and employment, despite facing only non-tariff measures (NTMs). This is because NTMs make up the largest share of the BRI. Additionally, many subsectors within light manufacturing have some of the highest import demand elasticities. For example, goods such as cork, base metal articles, vehicles, toys, and sports equipment exhibit very high import demand elasticities.

Table 11 - Sectoral impact of Tariffs, NTMs and TAB restrictions in India

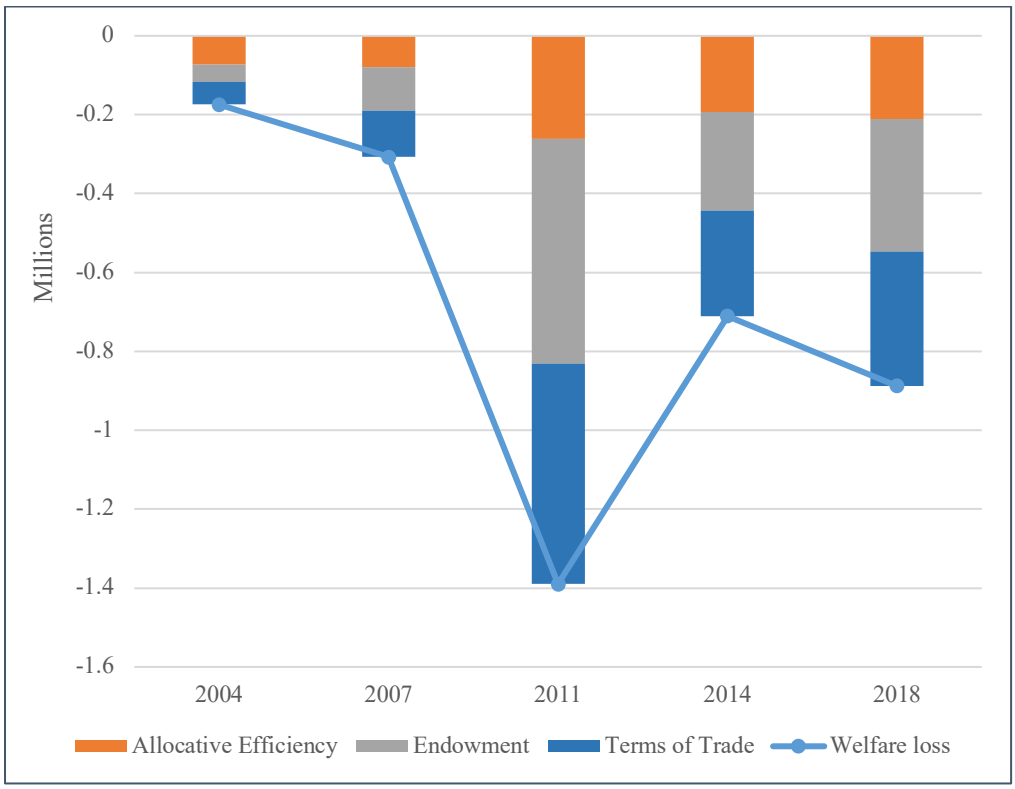
Trade restriction	**Sectors in which exports were adversely impacted in different years**	**Output**	**Employment**
Tariff	Grains and Crops – 2004 - 2018 Fishing, Forestry and Extraction – 2004 – 2011, 2018 Food - 2004 Textile and Wearing apparel – 2004 - 2011	Fall in output of all the impacted sectors mainly due to fall in	Employment of all factors except natural resources negatively impacted in all sectors in the

	Heavy Manufacturing – 2004 - 2011	share of export demand.	initial years. In the more recent years natural resource employment too was negatively hit in these sectors.
NTMs	Light Manufacturing – 2004 - 2018 Heavy Manufacturing – 2004 -2018		
TAB	Meat and Livestock - 2004 - 2018 Heavy Manufacturing - 2004 -2018		

Source: Based on the Author's simulation results

Figure 9 illustrates India's welfare position under the scenario depicted in Simulation I, where exporters face trade restrictions based on total BRI. India has experienced persistent and growing welfare losses over the years. While the share of allocative efficiency in total losses has remained stable, the contributions of terms of trade and endowment effects have increased significantly over time.

Figure 9 - Welfare change (Million USD) due to BRI faced by Indian exporters (Simulation I)



Source: Based on the Author's calculation from GTAP results

Tariff shocks initially caused welfare losses, driven mainly by substantial terms of trade and allocative efficiency losses, along with some endowment losses. However, in recent years, as average tariffs declined, India achieved welfare gains despite some partner-imposed tariffs. The growing impact of NTMs became the largest contributor to welfare losses, affecting terms of trade, allocative efficiency, and endowments. Although TABs are smaller shocks and do not cause total welfare losses, they have resulted in notable allocative efficiency losses, which have intensified over the past decade (Table 12).

Table 12 - Welfare change (Million $) due to various components of BRI faced by Indian exports as captured in Simulation II - IV

	2004	2007	2011	2014	2018
Simulation II : Tariff Shock	**-1846.5**	**-357.3**	**2921.4**	**5082.2**	**5474.8**
Allocative Efficiency	-780.26	33.9	349.5	873	1041.5
Endowment	-61.9	365.2	1760.3	2475.9	2528.5
Terms of Trade	-1004.3	-756.4	811.7	1733.3	1904.8
Simulation III : NTM Shock	**-162173**	**-296313**	**-1364446**	**-688769**	**-867481**
Allocative Efficiency	-69105	-77719	-254754	-188219	-205955
Endowment	-40719	-107607	-562179	-243577	-329918
Terms of Trade	-52349	-110987	-547513	-256973	-331608
Simulation IV : TAB shock	**2682.9**	**847.3**	**2585.1**	**3804.7**	**2051.5**
Allocative Efficiency	275.6	-933.1	-2522.8	-2102.9	-2337
Endowment	985.9	506.8	2439.3	2708.9	2094.2
Terms of Trade	1421.4	1273.7	2668.6	3198.7	2294.2

Source: Based on Authors' calculation

Evaluating the indirect impact of trade restrictions on macroeconomic and welfare variables of India's import partners

This section evaluates the macroeconomic and welfare impact of indirect restrictions on India's importing partners. These barriers, as measured by the Indirect Bilateral Trade Restrictiveness Index (IBRI), represent the restrictions that percolate back and negatively affect the importing

countries themselves when they impose trade restrictions on an exporting partner—in this case, India.

For examining the indirect impact of the exporters' DBRI on the importing partners, the study conducts another set of four simulations through GTAP data by calibrating various scenarios involving total IBRI and each of the three DBRI components contributing to this IBRI.

- Simulation I: Each of the import partners of India is subject to trade restrictions as presented by IBRI
- Simulation II: Each of the import partners of India is subject to the IBRI only due to tariff restrictions part of DBRI
- Simulation III: Each of the import partners of India is subject to the IBRI only due to non-tariff restrictions part of DBRI
- Simulation IV: Each of the import partners of India are subject to the IBRI only due to the TAB restrictions part of DBRI only.

The simulation results are summarized in Table 13 and Figures 10 - 14. Table 14 highlights the sectoral impact of IBRI on India's trading partners from 2004 to 2018, revealing adverse effects on their imports. The decline in imports has been primarily driven by a substantial reduction in intermediate imports, which significantly affected overall import volumes. Both developed and developing countries experienced a similar decline in imports by producers. Since 2004, intermediate input demand as a share of total import demand has decreased by an average of 74.5 per cent in developed countries and 73 per cent in developing countries.

The key sectors which reported a decline in imports include textiles, wearing apparel, light and heavy manufacturing, meat and meat products, grains and crops. Among these, textiles, apparel, light and heavy manufacturing are the most affected, reflecting their greater sensitivity to import price increases due to higher import demand elasticities. The combination of high import demand elasticity and the significant share of intermediate inputs in total imports from India exacerbated the adverse effects of IBRI on these sectors in the importing partner country.

Table 13 - Sectoral impact of IBRI on importing partner

Import Partners	Top five commodities where import from India is affected	Average share (%) of intermediate demand decline in the decline in import
Developed Countries		
Belgium	Textile, wearing apparels, grain crops, light manufacturing, meat and animal products	93
France	Textile, wearing apparels, heavy manufacturing, light manufacturing, grains and crops	74
Germany	Textile, wearing apparels, heavy manufacturing, light manufacturing, grains and crops	69
Hongkong	Light manufacturing, textile, wearing apparels, processed food, meat and meat products	55
Italy	Textile, wearing apparel, light manufacturing, heavy manufacturing, food, meat and meat products	71
Japan	Textile, wearing apparel, extraction	88
Korea, Republic	Meat and meat products, textile and wearing apparels, grains and crops,	100
Netherlands	Textile, wearing apparel, heavy manufacturing, light manufacturing, food, meat and meat products	67
Singapore	Extraction, grain crops and textile and wearing apparels	100
Spain	Textile, wearing apparel, light manufacturing, heavy manufacturing, meat and meat products, food	78
United Kingdom	Textile, wearing apparel, grain crops, light manufacturing and extraction	47

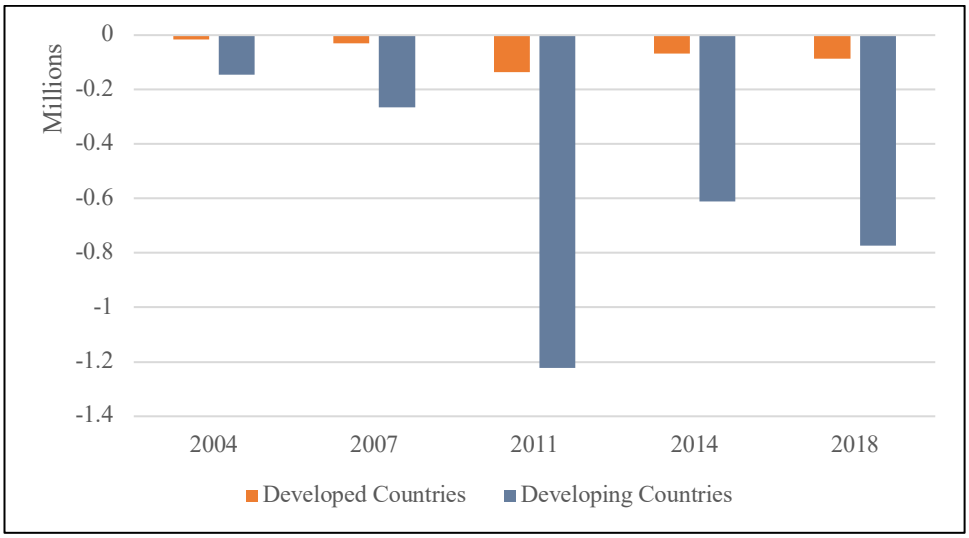
Import Partners	Top five commodities where import from India is affected	Average share (%) of intermediate demand decline in the decline in import
United States	Textile, wearing apparel, heavy manufacturing, light manufacturing, food	52
Average of Developed countries		**74.5**
Developing Countries		
Bangladesh	Textile, wearing apparel, light manufacturing, heavy manufacturing, meat and grains and crops	64
China	Textile, wearing apparel, meat and meat products, grains and crops, light manufacturing	99
Indonesia	Textile, wearing apparel, light manufacturing, grains and crops, heavy manufacturing, meat and meat products	95
Malaysia	Light manufacturing, meat and meat products, extraction, textile and wearing apparels and grains and crops	87
Mexico	Textile, wearing apparel, heavy manufacturing, light manufacturing, extraction, processed food	70
Nepal	Grains and crops, processed food, light manufacturing, extraction, textile and apparel,	44
Saudi Arabia	Light manufacturing, heavy manufacturing	34
South Africa	Textile, wearing apparel, light manufacturing, heavy manufacturing, grain crops	72
Sri Lanka	Light manufacturing. heavy manufacturing, meat and meat products, textile and wearing apparels and food	70
Thailand	Extraction, textile and wearing apparels, grains and crops	100

Import Partners	Top five commodities where import from India is affected	Average share (%) of intermediate demand decline in the decline in import
Turkey	Textile and wearing apparels, grains and crops, meat and meat products, food, light manufacturing	81
United Arab Emirates	Light manufacturing, heavy manufacturing	48
Vietnam	Textile and wearing apparels, meat and meat products, food, light manufacturing and grains and crops	76
Average of Developing countries		**73**

Source: Based on Author's simulation results

The adverse impact of IBRI on import volumes for downstream firms in India's trading partner countries has significant implications for their welfare. As shown in Figure 10, both developed and developing countries experienced welfare losses over the years, with developing countries facing significantly higher losses than their developed counterparts.

Figure 10 - Total welfare scenario of trade partners due to IBRI



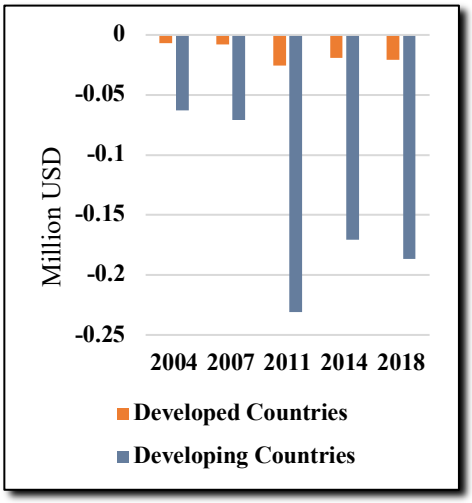
Source: Based on Authors' calculation from GTAP results

In the case of developed countries, welfare losses have been primarily driven by a decline in allocative efficiency, along with some endowment losses. Similarly, in developing countries, allocative inefficiency has been the primary factor behind welfare losses. However, endowment losses and terms of trade deterioration contributed a substantially higher share to the overall welfare loss in these countries (see Figure 11, panels a-c).

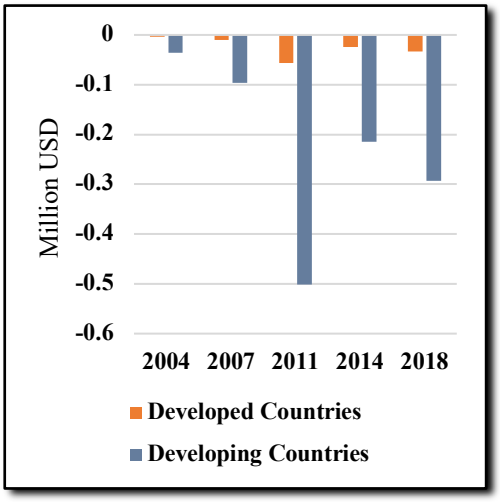
The rise in import prices of inputs led to significant resource inefficiency in downstream production sectors located in the importing country, further contributing to their endowment losses. Additionally, some importing countries faced worsening terms of trade due to higher import prices triggered by the import restrictions they imposed on India and the resulting IBRI they experienced.

Figure 11a - Allocative Efficiency loss due to IBRI; Figure 11b: Endowment loss due to IBRI; Figure 11c: Terms of trade loss due to IBRI

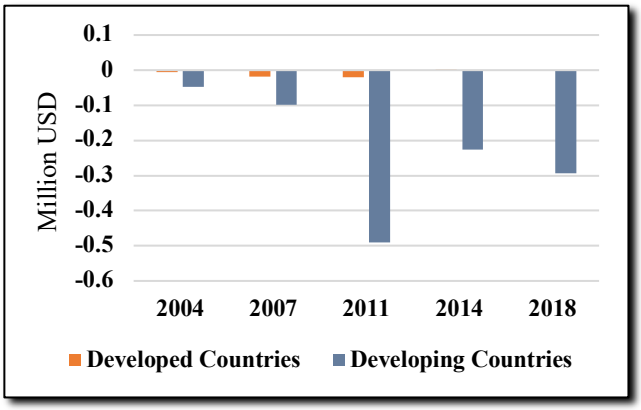
Allocative Efficiency loss due to IBRI



Endowment loss due to IBRI



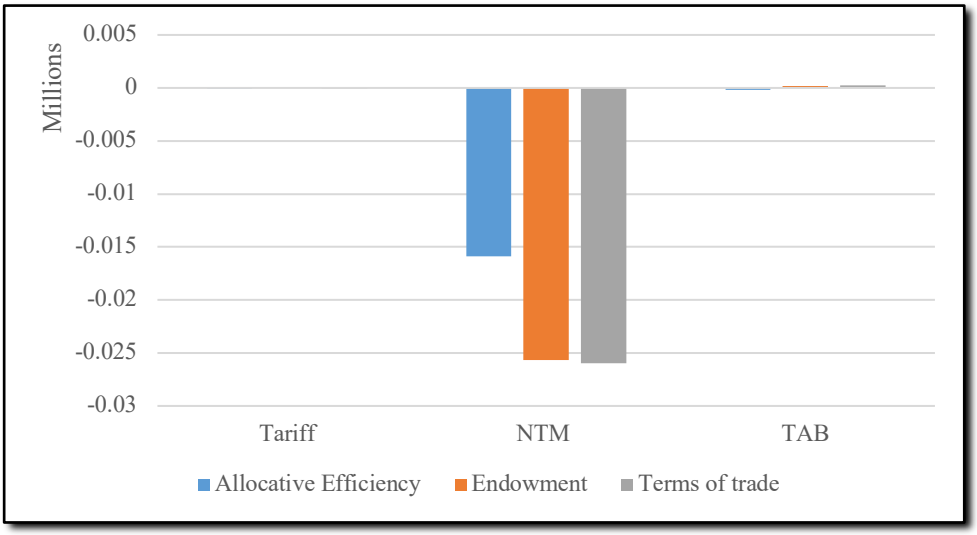
Terms of trade loss due to IBRI



Source: Based on Author's calculation from GTAP results

The analysis of the components of DBRI contributing to IBRI (Figures 12 and 13), which led to welfare losses for India's developed and developing trade partners, reveals that the average losses over the years in both groups of countries are almost entirely attributable to NTMs they imposed on India. Although tariffs caused losses in the initial years and TABs led to allocative efficiency losses in more recent years, the rise and persistence of NTMs, coupled with abysmally high corresponding AVEs, have made NTMs the primary driver of welfare losses over the past two decades (Figures 13and 14). The high NTMs imposed by developed countries on Indian exports had a price-rising effect, which adversely impacted their terms of trade and endowments, along with a smaller yet significant impact on their allocative efficiency. In contrast, the NTMs imposed by developing import partners on India had a comparatively smaller but notable effect on their terms of trade and endowments, while causing a substantial impact on their allocative efficiency.

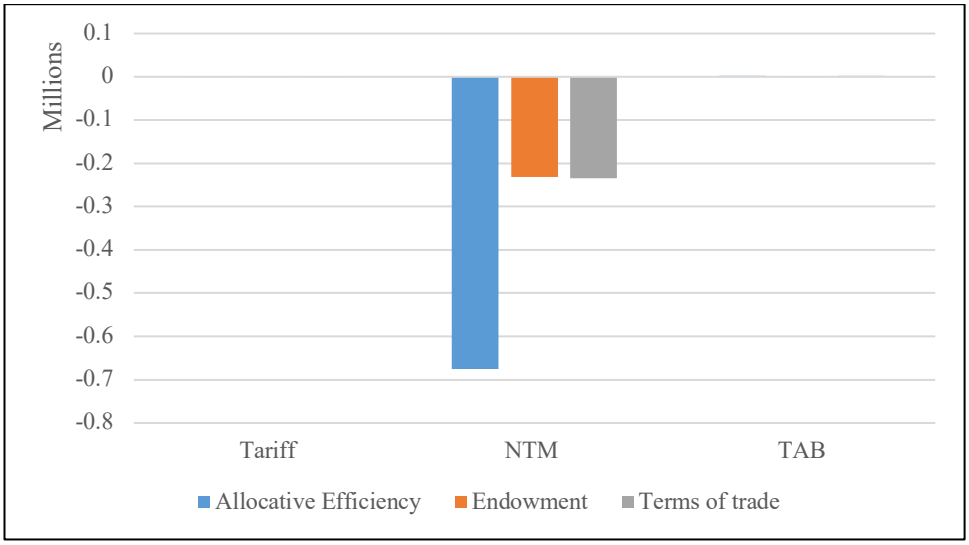
Figure 13 - Welfare component-wise average loss to developed countries due to IBRI



Source: Based on Author's calculation from GTAP

Note: Average is across the five base years – 2004, 2007, 2011, 2014 and 2018

Figure 14 - Welfare component-wise average loss to developing countries due to IBRI



Source: Based on Author's calculation from GTAP
Note: Average is across the five base years – 2004, 2007, 2011, 2014 and 2018

8. Conclusion

The analysis follows a three-step approach. First, it examines the direct bilateral trade restrictions imposed on exporters by import partners and quantifies these restrictions using a measure referred to as the Direct Trade Restrictiveness Index. This index is an augmented measure of trade restrictiveness that incorporates tariffs, non-tariff measures, and administrative and procedural requirements related to cross-border trade. Next, the analysis focuses on the indirect trade restrictions faced by import partners as a consequence of the trade restrictiveness imposed on exporters. This step examines the impact on import partners that rely on raw materials and intermediate goods from the exporting country, thereby addressing the broader implications of initial trade restrictions on downstream countries along the global supply chain. To facilitate this investigation, an Indirect Trade Restrictiveness Index is developed, corresponding to the Direct Trade Restrictiveness Index formulated earlier.

Finally, the computable general equilibrium (CGE) framework, using the GTAP database, is employed to evaluate the impacts of direct trade restrictions on the exporting country and indirect trade restrictions on the importing country. This assessment considers the effects on

output, welfare, and employment. Based on these findings, the study offers policy recommendations and identifies areas for future research. By examining India—the study analyzes the trade, macroeconomic, and welfare implications of these barriers on the Indian economy and its trading partners.

8.1 Summary of findings of the study

(i) *Direct bilateral trade restrictions imposed on exporters by import partners as measured by the augmented measure of direct trade restrictiveness based on tariff, non-tariff and administrative and procedural requirements related to cross-border trade*: Analysis of the DBRI experienced by Indian exporters for 20 key export products across 25 major import partners reveals three distinct phases in its evolution. The initial phase (2003–2007) is marked by relative stability, with the restrictiveness index maintaining a moderate average of 23 per cent. The subsequent period saw a dramatic escalation, with the index more than doubling to reach its peak at 67.3 per cent in 2013. The third phase, beginning in 2014, shows a welcome reversal, with the average DBRI stabilizing at 39 per cent, indicating a significant easing of trade restrictions. Nonetheless, Indian exporters continue to face substantial trade barriers.

The findings demonstrate that while the overall share of tariffs in total direct bilateral trade restrictiveness has declined over the years, there has been a notable increase in the prominence of NTMs and TAB requirements. A distinct pattern also emerges in the nature of trade barriers across economies: developing countries primarily impose significant border costs, whereas developed economies rely more heavily on NTMs. Furthermore, the study accentuates a critical yet often overlooked dimension of trade barriers—trading across borders (TAB) restrictions. These restrictions, traditionally commanding a smaller share of overall trade barriers and receiving limited attention in trade agreements, have a substantial impact, particularly when combined with tariffs and NTMs. This issue is especially relevant for India, given the evolving composition of its export basket toward heavy manufacturing sectors such as chemicals and machinery. These sectors face stringent NTMs in developed countries and trade-hindering border costs in developing countries.

(ii) *Indirect bilateral trade restrictions on import partners due to trade restrictiveness imposed on Indian exporters by the import partner*s: The results of the study indicate

that a direct bilateral trade restrictiveness index (DBRI) of 39 per cent results in a total indirect bilateral trade restrictiveness index (IBRI) of 3.1 per cent, which the top twenty-five importing partners effectively impose on themselves. This finding highlights that trade restrictions imposed by an importing country on a specific country's exports can significantly amplify restrictions across all downstream nations in the supply chain. Although smaller in magnitude, these indirect restrictions remain persistent across import partners throughout the study period.

An analysis of the components of indirect trade restrictiveness reveals that non-tariff measures (NTMs) account for a dominant share of 95 per cent, while tariffs and trading across borders (TAB) requirements contribute 3.9 per cent and 0.03 per cent, respectively. The magnitude of IBRI is influenced by multiple factors, including the proportion of intermediate goods in total imports, the extent of DBRI faced by exporters, the composition of the export basket, and product-specific DBRIs.

(iii) *Economy-wide impact of direct trade restrictiveness on the exporting country and indirect trade restrictiveness on the importing country:* The findings of the computable general equilibrium analysis of the economy-wide impact of direct trade restrictions on India and indirect trade restrictions on India's importing partners reveal significant insights. For India, trade restrictions have reduced exports, output, and employment, leading to considerable welfare losses over the years. The light manufacturing sector has been the most affected across all these variables. Initially, tariffs were the primary contributors to welfare losses. However, over time, non-tariff measures (NTMs) have emerged as the largest contributor, adversely affecting the economy's terms of trade, allocative efficiency, and endowments. Despite their smaller magnitude, TABs have also caused notable allocative efficiency losses, which have intensified over the past decade.

The impact assessment of indirect barriers to trade (IBRI) on importing countries shows that these restrictions have led to a decline in imports from India, primarily driven by reductions in intermediate imports. Key affected sectors include textiles, wearing apparel, light and heavy manufacturing, meat and meat products, grains, and crops. This reduction in imports has resulted in welfare losses for importing countries, with developing countries experiencing significantly higher losses than developed ones. In developed countries, welfare losses have primarily stemmed from declines in allocative

efficiency and, to a lesser extent, endowment losses. In developing countries, while allocative inefficiency remains the main driver of welfare losses, endowment losses and terms-of-trade deterioration have contributed a much larger share to the overall welfare impact.

8.2 Policy Recommendations based upon findings of the research

Global trade flows are significantly affected by trade barriers, including tariffs, non-tariff measures (NTMs), and costs associated with trading across borders. The findings of this study confirm this and highlight the adverse impacts of these trade barriers on the macroeconomy, trade, and welfare of both the exporting country and its importing partners within the global value chain.

Based on the study's findings, the following recommendations are proposed. These are organized under two separate headings: the first section offers policy inputs at the global level, while the second section provides specific policy recommendations in the Indian context.

A. Policy recommendations for global trade

a) *Targeted approach to trade negotiations:* The findings recommend that policymakers should embrace a more detailed and targeted approach to trade negotiations, focusing on sector-specific barriers and addressing the unique challenges faced in different markets. For example, in trade negotiations with developing countries, more importance should be given on addressing the types of cross-border trade barriers that are more prevalent in these countries compared to developed ones. Conversely, negotiations with developed countries should prioritize identifying and mitigating the actual impacts of non-tariff measures (NTMs). The same approach applies to different types of goods within the export basket. It is essential to assess and identify the specific nature of restrictions faced by particular goods in specific markets.

b) *Emphasis on non-tariff measures:* Given the dominance of non-tariff measures in restricting trade and their resurgence in the current challenges including trade war and multiple geo-political conflicts, there is a pressing need for greater international cooperation in harmonizing standards, streamlining regulations, and enhancing transparency in trade-related procedures.

c) *Restrictions due to the border costs:* One of the most important contributions of the study has been its assessment of the border costs at importer's end, especially the high restrictions at the borders of the developing countries. As a critical input to the trade policymakers, the simplification, harmonization and reduction of border costs in the future may have significant bearing on the quantum and direction of world trade.

d) *Global value chain considerations:* The observed indirect effects of trade barriers highlight the importance of considering global value chain dynamics in trade policy formulation. Policymakers should assess the potential impacts of trade measures on both direct trading partners and other countries involved in the production network.

e) *South-South cooperation:* The high trade barriers observed between developing countries underscore the need for enhanced South-South cooperation to reduce trade frictions and promote economic integration among emerging economies.

B. Policy recommendations for Indian exports

Specific policy recommendations to augment Indian exports based on the observations of the study have been detailed below:

a) *Export diversification:* The varying elasticities and trade barriers across product categories suggest that India and other developing countries could benefit from diversifying their export baskets to include more specialized goods and natural resources, which face lower demand elasticities.

b) *Value chain integration:* The analysis of indirect trade restrictiveness highlights the potential benefits of deeper integration into global value chains, particularly in sectors where India faces lower total trade barriers.

c) *Sectoral competitiveness:* The findings on sector-specific trade barriers provide valuable insights for industries looking to enhance their international competitiveness. For example, the agricultural sector may need to focus on improving compliance with international standards and streamlining export processes to overcome significant border and documentary barriers.

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